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The Architecture of Cambodia.

It is now a good many years since the first information reached us of the existence of a very remarkable series of architectural ruins in Cambodia, or Cambaja, as it has been indifferently spelt. From time to time fresh accounts of these remains, by occasional travellers, have been published, generally, however, of a somewhat brief and meagre description. In May, 1874, we printed a synopsis of a paper read on the subject before the Society of Arts, by Mr. H. S. Kennedy; and in July, 1877, we again drew attention to the subject, and gave a few further particulars as to the nature and extent of these remains. All the information then available was, however, of a restricted and desultory nature. Those who wish to know more of this remarkable group of architectural remains have now, however, the opportunity of forming a very good idea of their details and characteristics through the researches of Lieutenant Delaporte, of the French Navy, who spent some time in the systematic exploration and sketching of the ruins, accompanied by a sufficient party of assistants and native servants, and who was also instrumental in bringing over some specimens of the sculpture to France, where they formed strange and uncouth groups in the galleries of the Trocadéro in 1878. The expedition was, in fact, as we gather, one of official institution, an addition to the long list of Governmental explorations of this kind which have been so honourable to France. The results are embodied in a book, "Voyage au Cambodge," published by C. Delagrave, Paris, and profusely illustrated, and which affords for the first time opportunity for some detailed consideration of the architectural peculiarities of the Cambodian style.

Perhaps there are not a few of our readers who are not for the moment very clear about the geographical position and limits of Cambodia, or Cambodge, as the French reading of the name goes. It is a region on the east coast of the Gulf of Siam, southwards of the present kingdom of Siam; a district mostly in the condition of forest and morass, and interspersed with the remarkable ruins, now mostly half-overgrown with tropical vegetation, which show that it was once the seat of one of the richest and most gorgeous of Eastern principalities. Southward, again, of this district is the strip of territory over which the French Government hold sway, and known as French Cochin-China. It was natural that the proximity of the French power in the neighbourhood should have led to its exploration by Frenchmen, and to the official assistance of the French Government,—which has always shown such an enlightened interest in exploration of this kind,—in subsidising an expedition for the purpose, the report of which furnishes, as we have observed, the best and most reliable information on the architecture of the district.

The remains are clustered in the greatest number near the shores of the great lake into which fall a number of the principal tributaries of the river Mekong, which forms the great drain from the lower end of the lake, and reaches the sea eventually by the large delta which cuts right across the French possession on the coast. Near the head of this lake are found the remains of the ancient capital of Angkor, which include some of the largest and most elaborate of the ruined temples and palaces. Somewhat to the east of the lake are Melea and Prea-khan, two of the finest and most important of the remains. Others are scattered about at considerable distances.

What are the main characteristics, and what is the history of these masses of elaborate and barbarously ornate architecture scattered over this portion of Asiatic soil? The former question can be more easily answered than the latter. For the history there seem to be no reliable data attainable. We have little more than conjecture, combined with some partial records in Chinese archives. The kingdom of Cambodia is traditionally a very old one, going back to the early centuries of the Christian era, but no one would attribute the structures we are now considering to that date. Probably they may range from the thirteenth to the fifteenth century, or thereabouts. The great similarity in style and detail of the various remains, so far, at least, as illustrated in the report of M. Delaporte, seems to negative the idea of their being distributed over a large extent of time, and to lead to the conclusion that they represent the prevalent architectural style of the country during the period of its greatest power and prosperity.

The remains which present such remarkable spectacles to the traveller appear to be nearly all those of temples, or perhaps of temples and palaces combined in the same group of buildings,—a view which some of M. Delaporte's remarks seem rather to lean towards. A portion of the ruins at Angkor, at all events, presents the suggestion of having been part of a palace. But, in the other cases, the remains seem to be those of temples. Their plan is, in the main, similar to that found in the Hindoo temples,—in general scheme at least. The restored plan of the temple of Baion, the principal temple at Angkor, shows the general characteristics of the plan of those buildings. There is a great quadrangle of buildings raised on a platform, and approached on the centre of the principal entrance-face by a terrace or a bridge, and with towers at the centres and angles; within this is a smaller quadrangle of buildings, leaving a pretty wide space between the two, and in the centre of the buildings forming this quadrangle is the actual temple. In mentioning the bridge, it should be observed that the combination of water with the disposition of the masses of architecture seems to have been a special feature of these temples, whether for greater seclusion and protection or for architectural effect, or, as is perhaps most probable, for the performance of religious rites. All the large remains seem to be situated on or near the various tributaries of the river Mekong, but they also appear both from the views of the existing remains and from the restorations that are given, to have nearly always had in front of them a sheet of water built round with terraces, and crossed in the centre by a bridge leading up to the principal entrance. Probably, these quasi-artificial sheets of water partly forced themselves into the scheme of the architectural disposition, in a country which seems to have been very flat and marshy, and intersected with rivers and small lakes in every direction; and no doubt the lakes or large moats before the buildings were connected with rivers in many cases, and formed one medium of intercommunication; though it would appear from the account of the French exploring party that some, at least, of the rivers in their present state are so choked with luxuriant vegetation as to render their passage exceedingly difficult. In a country where vegetation seems to be so prolific in its growth, a comparatively short period, after the cessation or removal of civilisation, would suffice to render nearly impassable streams which might have been kept passable for navigation in former times. These bridges of approach appear to form one of the most remarkable and characteristic features of the architectural remains of the country. A view of one of them as at present existing is given in one of the illustrations, and more than one restored view gives an idea of their appearance when new, ample details for such restoration existing still. They are carried on numerous and massive piers, leaving a very small water-way, and are remarkable for the profuse enrichment of the piers with sculpture, and for the very elaborate and peculiarly-designed balustrades which surmounted them on either side of the roadway, and of which large portions are still *in situ*. Looking at one of these bridges from the water level, we see a row of massive grotesque caryatide figures, with human female torsos, and what look like grotesque lions' heads, and which support on the upraised hands a highly-enriched entablature; the bodies rise from among a cluster of gigantic serpents also with grotesque and quasi-human heads; between each of these larger figures the space is partly filled up with a cross-legged statue of a Hindu deity, on a much smaller scale than the main figures. The piers are so close that the main caryatide figures form a continuous row. The narrow waterway between the piers is spanned by stone lintels, very near the water, and leaving no headway for a boat, even were there width enough between the piers. The whole construction

might be more correctly termed, perhaps, a causeway than a bridge. The balustrade is in most cases formed of a long very thick stone rail, sometimes partially suggesting in its surface treatment the body of a gigantic serpent, and which at the entry on the causeway is turned up several feet into the air and expands into a many-headed serpent, sometimes with a central grotesque face around which the serpent-heads form a portentous-looking aureole. In some cases the balustrade is supported by cubical blocks of masonry, carved with bas-reliefs of figures; in other cases it is supported by a long row of grotesque kneeling figures, one behind another, who seem to bear up the balustrade in their hands. The whole combination seems the result of the wildest and most grotesque fancy expressed with unstinted labour and elaboration of workmanship.

The architecture of the temples themselves, however, throws all such details into the shade, in the extraordinary and unexampled combinations which it displays. It seems like the result of a nightmare supervening upon the study of a medley of architectural details of many different styles. The main effect of the whole, no doubt, is essentially Indian. As the plan recalls that of the Hindu temple, so the outlines recall those of the Hindu pyramidal gate-towers. Mingled with these, however, are details more uncouth and illogical than anything in Hindu architecture, mingled with beautiful and elegant forms which seem derived from Classic architecture, while we come upon bits of ornament which seem closely related to Renaissance forms. Our first illustration (fig. 1)* is a view taken among the ruins of the temple of Baion. Here we have some of the main peculiarities and contradictions of Cambodian architecture just as it now remains. Colossal faces, with all the calm immobility of the Egyptian colossal sculpture, are framed in ornaments of great elaboration and elegance, the whole being, however, from the architectural critic's point of view, completely out of scale, and dwarfing all the rest of the structure. In the midst of this grotesque and barbaric architecture, we can see, in this illustration, a portion of the other, the semi-Classic element in Cambodian architecture, the square pilaster with its capital, somewhat heavy, but not destitute of fair proportions, and, as a nearer view would show us, of very elegant as well as rich detail. The base mouldings are very heavy, certainly; but this defect is not always found in such details. The base of a square column which is given in figure 4, not from this temple, but from another at Prea-Khan, shows how much elegance and refinement is found in some of these details, and how strong a resemblance to Classic forms. Almost the only fault to be found with the ornament here is, that it is redundant (to our notions) for such a position, and might seem more suitable if reversed and regarded as a capital. This objection, however, does not apply so strongly in the case of buildings in which, as in these Cambodian structures, almost every square foot is ornamented with carved work. The idea of reticence in ornament never belonged to the Eastern mind; richness of effect is the object aimed at, and a blank space seems almost to be regarded as an anomaly. The extent to which this exuberance of decoration has been carried is well shown in the head of a doorway from one of the temples at Angkor (fig. 3), in which also the singular juxtaposition of semi-Classic and Oriental forms and feeling is strikingly illustrated. The carving over the lintel is completely Oriental in feeling and type, and very fine and bold design is shown in the foliage work among which the numerous figures are introduced. The ornament of conventional serpents which forms a decoration round the head of the central recumbent figure is similar in type to the treatment which we have already described as occurring in the terminations to the balustrades of the causeways or bridges to some of the temples, though less elaborate. In the mouldings of the door-architrave below we have, on the other hand, very strongly-marked Classic feeling, both in the proportions of the mouldings and in the style of the ornaments. The form which some of these quasi-Classic ornaments assume is shown on a larger scale in figure 5, from another temple again (at Phnom-boc). This looks like a Roman elaboration of the egg-and-tongue ornament translated into Indian detail: the main form is much the same, the symmetry of detail, and the regular alternation of the two forms which constitute the design, are carried out with complete finish. The similarity between some Cambodian details and some constantly-recurring Renaissance forms is most curiously illustrated in the pretty bit of detail given in figure 6, from the temple of Melea, not very far from Angkor. Here we find not only the precise elements which characterise an extensive and familiar type of Renaissance ornament,—the intermingling of figures with scrolls of conventional foliage on which the figures are lightly placed, and the growth of the scroll ornament out of a central figure,—but we see even in the foliated ornament a strong resemblance to Renaissance form. The figures alone are Oriental; take them away, and the design might almost pass for a bit of Renaissance ornament, rather perhaps of the French than of the Italian type. The strangest circumstance is the intermingling of forms so graceful and in such pure taste with the employment in the same buildings of such wild and waywardly grotesque fancies and outlines. In this peculiar combination the Cambodian architecture seems to stand alone, and furnishes a new chapter in the history of architectural ornament.

Figure 2 is a restoration of one of the gates at Angkor, part of the data for which (not inconsiderable) are given in the report, in a view of the actual state of the ruins, which we have not space to reproduce. Here we can see in a more concentrated *coup d'œil* the heterogeneous elements which go to make up this extraordinary architecture. We have the semi-classic pilaster, with capitals and bases evidently very similar to the specimens shown in figure 4; in this case the capital actually appears to be very nearly the base reversed. Over this comparatively Classic feature with its straight architrave (rather too light for the column), we see the curious serpentine lines of the porch pediment, ending at each angle in a group of serpents' heads, and really appearing as if brought from some other region and arbitrarily placed above the columns, which do not seem in the least to belong to the same style. The upper part of the structure represents the same characteristics which are shown in the ruins of Baion in figure 1, the gigantic faces crowned with towers in many stages, and broken up into a great multiplicity of small details. This same view also gives some idea of the extent to which animal forms, as in Indian architecture very often, are worked into the architectural design, and form an integral part of it. Elephants, lions, and serpents are the great objects of animal sculpture among the Cambodian remains, but they are treated with rather curious distinctions. The elephants are always treated in a comparatively realistic manner, though generally (as the figures introduced in this view show) of colossal size; the lions and the serpents are always much conventionalised in what appears to us a grotesque taste, though it may not have been intended so by the original designers. But while the elephants and serpents are usually an integral part of the architectural ornament of the buildings, the lions seem never to be used in this way, but to be treated only as separate statues along the terraces, where some of them are still in their upright positions, though more or less damaged, and others overturned. These lion statues are mostly seated nearly upright on their hind-quarters, the fore-paws extended, somewhat after the manner of the "lions rampant" of heraldry. The modelling is awkward and unlike nature, and the surface of the body is many cases covered with ornament, in a manner which still further removes them from anything like natural effect. They are, to say truth, clumsy and hideous objects, in very barbarous taste. The elephants, on the other hand, seem to be modelled with considerable freedom and truthfulness to nature. A fragment of a piece of pottery, with handles in the form of elephants' heads (see fig. 7), is an example of the ornamental use of this animal in Cambodian work. Some such specimens as this have been imported to France, and already, we are told, have found their imitators and reproducers in modern French ornamental design.

One or two practical points in regard to the plan and construction of the Cambodian buildings are worth special notice. One is, the use which is made of small breaks in the plan, with the view of heightening architectural effect and marking out the grouping better. This is especially observable in the plans of the buildings which form crossings: as the crossing is approached the width of the four aisles is gradually widened by slight breaks, so that the plan expands from the extremity of the arms towards the crossings. This shows a true appreciation of internal architectural effect. Another very curious structural point is to be noticed, viz.: that some of the large stone lintels which carry a considerable weight over a wide bearing are only stone lintels in outward appearance; they have been cut into, and wooden beams inserted in the centre to give greater bearing power. Thus it appears that the sin of concealed construction is confined neither to modern times nor to Western nations.

As to the absolute architectural merit of the Cambodian temples, apart from their historical interest, it appears to us to reside in two qualities,—in effective planning, and in the richness, and often, great beauty, of the minor architectural details, the running enrichments, and such features. The French explorers, to whom we owe this more complete account of the remains, have got up a great deal of enthusiasm about their grandeur, and speak of their architects as "these Michelangelos of the East." This enthusiasm over such works is, of course, the most natural thing in the world on the part of those who have done much to discover and illustrate them; it is hardly to be expected that it should be otherwise. But those who are able to consider the subject with the calmer judgment of unbiassed critics, will hardly accept this view as to the artistic value of these strangely-grouped structures, or regard them as furnishing us with a new phase of architectural beauty equal to, though differing from, the beauty of Greek, or even of Roman, architecture. Granting the two points we have already conceded to it, the effectiveness of the plan and the beauty of some of the detail, the architecture represented in such views as our figures 1 and 2 appears to us to represent some of the most hideous and uncouth architectural conceptions that men have ever seen elaborated into form. To compare it with Egyptian architecture, as its French patrons (if we may so style them) do compare it, is the most cruel injustice to the memory of the Egyptians. Their architecture was, on the whole, a very civilised and logical one: certainly it appears strikingly so in comparison with these Cambodian nightmares of design. If the Egyptians made large use of colossal sculpture, they knew better than to build it into their structures in such a manner as to confuse the whole idea of scale. They treated their colossi as great features supplementary to, and used in combination with, the architecture; but not as a part of it. If the Egyptians had sculptured a huge bas-relief of a human face on the walls of the pyramidal pylons, which formed the front of their temples, they would then have been doing much the same as the Cambodians did with their towers, and we can feel at once what a declension such a treatment would be from the actual merits of Egyptian architecture. This kind of enthusiasm over a newly-discovered form of architecture is a mischief in regard to the true criticism of architectural style, and we consider it a duty to protest against it. The Cambodian remains are most interesting and astonishing in their elaboration, but they represent the architecture of a barbarous and illogical taste.

* See p. 704.

THE NEW TAY BRIDGE.

AN intelligible account of the design for the new Tay Bridge is to be obtained from the perusal of the evidence taken before the Select Committee of the House of Commons on the North British Railway Company (New Tay Viaduct) Bill. The inquiry commenced on Monday, the 9th of May, in the Committee Room No. 8. After the destruction of the former bridge, at the end of the year 1879, the question of the passage of the Tay was held to be so important, that the North British Railway Company were allowed to deposit notices in 1880, long after the usual time. It was as late as July 8th that the Bill was referred to the Committee; and it was an instruction of the House that the Committee should report whether the site proposed was the best, or whether any more suitable point could be selected for crossing the Tay. The Board of Trade was represented before the Committee. The conclusions arrived at were:—1. That the bridge over the Tay should, in the interests of the public and of the railway company, be reconstructed; 2. That the site originally selected was the most suitable; and 3. That the reconstruction of the bridge at the lower elevation of 77 ft. over 4 spans of 245 ft. from centre to

centre of piers, instead of 88 ft., above high-water spring-tides, will occasion no undue interference with the navigation of the river; especially as the promoters have signified their intention, in case the bridge is rebuilt at the lower level, to provide a steam tug gratuitously for all vessels of above 70 tons register passing up and down within a mile of the bridge, and to keep the navigable channel clear.

The fourth point investigated by the committee regarded the provisions for the safety of the new bridge. As to that, doubt was entertained as to the feasibility of combining the old with any new work; and the decision has been to keep the new bridge clear of the ruins of the old one, although not very far removed from that site. The old bridge cost the sum of 350,000*l.*, of which the greater part is now totally lost. The estimate for the new bridge is 670,000*l.*; so that more than a million sterling will have been expended in crossing this important estuary. The North British Company ask to be allowed to charge for the bridge at the rate of ten miles of railway. Even at this rate the traffic must reach the large figure of 10,000*l.* per mile per annum in order to pay 5 per cent. on the outlay.

Opposition has been made on the part of certain of the traders of Perth to the Bill, on the ground that the provisions made therein in regard to the width and number of spans, and clear headway or height of such over the navigable channel, would prove highly obstructive and dangerous to the navigation of the Tay, and would seriously and injuriously interfere with the commercial rights and privileges of the merchants, traders, and importers of the port of Perth. The Town Council of Dundee, on the contrary, have petitioned in favour of the Bill. The weight that should be attached to the unpatriotic opposition of the Perth traders may be estimated from the fact stated by counsel (if true) that from 1850 to 1880 the gross annual tonnage on the Tay, crossing the site of the bridge, has sunk from 9,000 to 170. In 1830 there were 35 brigs, or similar vessels; in 1880 only 3. In 1850 there were 50 schooners; in 1880, 11. In 1850, 20 smacks; now 10. And no steamers. To accommodate a navigation of such almost imperceptible amount the petitioners demand that the bridge should be raised 11 ft., or from 77 ft. to 88 ft. above high-water level. Independently of the question of cost of construction, the difference between a clear height of 77 ft. and one of 88 ft. makes the difference between a gradient of one in 114 and of one in 74 over the bridge itself,—a difference of very great importance as concerns the permanent stability of the viaduct, and the safety of the public.

A model of two of the central piers and double girders was placed before the Committee, and Mr. W. H. Barlow gave evidence as to his design for the new bridge. The first step taken by Mr. Barlow when consulted by the directors was to make a careful series of borings throughout the entire extent of the river, in order to ascertain what foundations could be obtained. He further tested some of the piers by weights, selecting for that purpose two of those that had fallen; and in addition to this, he put down a trial cylinder of 8 ft. diameter.

Examination of the foundations of the old bridge convinced Mr. Barlow that it was requisite to make more allowance than had been before done for the scour of the river; and that the safest and best plan would be to put in piers for a double way bridge entirely independent of the old piers. The erection of the bridge on this slightly altered site will require the construction of two or three short pieces of railway, and from the shore to their junction solid stone piers will be employed. The total length of the new bridge is a little over 10,000 ft., or about two miles. It is similar to the old bridge with regard to the number of large openings. Each pier is opposite a pier of the old bridge. The wide spans are thirteen in number, eleven of 245 ft. each, and two of 227 ft. Only four of them are at the height of 77 ft. Beginning at the south end of the bridge, the first four arches are in brickwork, made very wide, to hold the two lines of railway. Passing from that point northwards, we come to the girders of 145 ft. span, up to the twenty-eighth pier. Then commence the large girders, being the four navigable spans of 245 ft., then a fifth span of the same width, then one of 227 ft., and then a few more of 245 ft., till we come to the end of the large spans. Then the spans, with the exception of the first, are all of 130 ft., up to pier 53, which changes to 70 ft. The width continues at 70 ft. till we come to the twenty small arches that cover the esplanade, where the line is curved.

The prime defect in the original Tay Bridge, to which we called attention in these columns immediately on the collapse of that structure, has not escaped the attention of Mr. Barlow. We refer to the want of proper anchor-plates, and holding-down bolts in the structure of the piers. "Solid piers," said Mr. Barlow,—and we wholly support the view,—"are better than lattice ones. The calculations are made for double the wind-pressure that will ever be brought to bear on the holding-down bolts." In reply to a question very pertinently put by Viscount Folkestone, Mr. Barlow said that the wind-pressure was calculated at 20 lb. per square foot, and that, in point of fact, the design allowed for 56 lb. pressure of wind and train. This is close upon the allowance made by the American engineers, and is, in our opinion, ample, if it be regarded as a probable strain that is not unlikely to come on the bridge,—the breaking strength being at least double. It would not, in our opinion, be safe if the breaking tension is put at less than 120 lb. per square foot of surface on which the wind can take hold, so as to exert a leverage against that resistance; and no doubt this is what is meant by the evidence.

The piers are to be solidly connected with the girders. At the underside of the latter there will be roller bearings, and the arrangement is such that every girder will be attached to two piers, and every pier to more than one girder. In the former design the continuous girders went over four or five, and, in one case, six spans, with only an attachment to one pier.

The parapet will be of wrought-iron, as a precaution in case of any vehicle leaving the rails. There are also strong balks of timber placed as fenders outside the rails, so that if the train ran off the wheels would have to mount on these balks before a carriage could strike the parapet. So, at least, we understand the evidence. The system has been adopted in America, and has been found to be very useful there.

It is intended to use some portion of the old girders, after proper testing, in the new structure. We have little doubt that the event will justify the statement of Mr. Barlow, to the effect that, having given a very great amount of study to the work, he feels confident that the bridge, if carried out in accordance with the designs, will be "very permanent, good, and safe."

THE LIABILITY TO PAY FOR QUANTITIES.

A PRACTICAL commentary on the discussion upon the question of quantities, which recently occupied so large a part of the time which the Conference of Architects gave to the consideration of professional topics, has been furnished by the case of Evans *v.* Carte, which was decided during the latter part of last month. At the same time, that case is one which possesses some peculiar features, and the report of it, as we find it in the *Times*, may be apt to make some readers take too decided a view of the subject. It is not necessary to go, for the purposes of the present remarks, into the details of the case, beyond pointing out that the action was by a quantity surveyor against the building owner for services done in respect of taking out quantities. But the service in question was required for the purpose of reducing the quantities, since the employer, finding the estimates for the plans as they stood too high, required the architect to alter them so that the building should cost a smaller sum; and there is this to be noticed, that the architect's estimate on the original plans and quantities was between 12,000*l.* and 13,000*l.*, whilst the lowest tender was 18,000*l.* Apparently the estimate of the architect had been about the sum which the employer intended to spend, because it is clear the latter was not satisfied with him, for directly after the quantities were reduced, Mr. Carte, the defendant, dispensed with his services. At the trial, the question of liability turned upon whether or not there was a direct authority from Mr. Carte to Mr. Emden, the architect, to have the work done by Mr. Evans, the plaintiff, and the jury, after much conflicting evidence was given, decided that the employer had so authorised the architect. The recent discussion arose upon the question whether there should be a new trial on the ground that the verdict was against the weight of evidence. This verdict was, in the end, upheld, not because, in the opinion of the judges, the jury had arrived at a right conclusion, but because it was not an unreasonable conclusion. The real cause of the decision, however, apparently was that the costs of a new trial would, taking those of the first into account, come to so much more than was at stake in the cause, that it was obviously a mercy to the litigants to put an end to further strife. For, if the report in the *Times* is correct, it is perfectly clear that the opinion of the three judges was that the verdict was against the weight of evidence. It is noticeable, firstly, in this case, that the liability of the employer was based on the ground of a direct authority to the architect to employ a quantity surveyor. Now, the great point made in all the recent discussions at the Institute, and on other occasions, has been that the employer is liable by custom; and yet here we have an important case in which custom is not mentioned at all, and yet, if it was not to be mentioned here, where there was a direct conflict as to direct authority, when should it be? But there is, as regards this case, an obvious distinction between it and the general liability of an employer to pay for quantities if a building operation does not take place from the quantities taken out, because, in this instance, the quantities were for the purpose of getting an estimate near the figure which the employer desired to pay, and therefore if the employer had given a certain limit to the expense, and that expense was obviously to be much exceeded, it was a fair argument that the employer should not be liable to pay for the reducing of the quantities. Therefore, it does not follow that this case is directly in point in regard to the more common and general question of the liability for paying for taking out quantities in the first instance.

On the other hand, again, it is clear that the mind of the judges was much against any customary liability on the part of the employer to pay for taking out quantities. Lord Coleridge distinctly stated in so many words that it was the duty of the architect, in that particular case, at least, to take out the quantities, and, if we recollect rightly, this is by no means the first time that the judges have shown themselves hostile to any customary liability on the part of the employer to the surveyor. This is a fact which architects should, therefore, make up their minds to face, because it is a very important fact for them. For it is not in straightforward cases, when all goes well, that these questions of liability arise, but when the parties, for some reason or other, cannot conclude the business amicably; and it is just on these occasions that the pinch comes, and the various theories broached at conferences and discussions are often rudely dispelled and broken in a law court. When a custom is set up it must be proved to be universal and reasonable, and if a judge considers it unreasonable that an employer should pay a surveyor, whom he does not directly employ, away goes the custom altogether. Again, it must be universal; but here, again, it is useless to shut our eyes to the fact that architects can be found to state that it is not universally the fact that employers pay the surveyor when the building does not take place. We have more than once chronicled such cases, and in the Irish case of Taylor *v.* Hall, one judge distinctly stated that he did not think such a custom had been proved;* and we call to mind, too, one case in the Mayor's Court, London, where the surveyor sued the architect personally, who pleaded that by custom the employer, and not he, was liable; but for all that he had to pay, as the judgment was against him. And now we have these strong expressions by the Chief Justice of England, so that no prudent lawyer can advise any surveyor that he can claim against the employer who has not given a specific order, except with the possibility that he may lose his case, and have to pay heavy costs. The conclusion to be drawn from these cases is obvious. The schedule of rules issued by the Institute should contain one recommending that, in all cases, the architect should inform his employer that quantities must be taken out, and that he should obtain a written authority from him to employ a surveyor for the purpose. Unless such a rule becomes general, these disputes will, from time to time, certainly occur, whilst, if a direct understanding is arrived at, such a dispute cannot possibly take place. Unfortunately, no amount of rules will make some professional men prudent; in some cases they will not even stick to

* Roscoe's "Digest of Building Cases," p. 45.

the plain letter of contracts, and are surprised if difficulties arise in consequence. It was only quite recently that we heard that an architect stated as a reason why he gave no written orders for extras, according to the stipulation in the contract, that such a condition in a contract was not to prevent litigation between builder and employer, but to prevent the architect from giving verbal orders unduly, so as to make the employer liable without his knowledge. Indeed, we have no doubt that this common condition, as to written orders, is in hundreds of contracts utterly neglected, and that, in consequence, numberless disputes arise, which, if architects and builders would adhere more closely to the letter of the agreement, would never take place. Therefore, when we find contracts not adhered to, the chance that rules will be strictly followed is not very great.

Obviously, however, such a tendency as that which the law now shows is towards making the provincial practice, namely, for architects to take out their own quantities, more common, and therefore it is clear that those who wish to make quantity surveying and the work of an architect distinct should endeavour to have some rule such as we have pointed to promulgated by the Institute. It will, at any rate, call attention to the question of liability, and with the law in its present state no prudent architect will neglect to obtain some kind of direct or indirect authority from the employer to make use of the services of a quantity surveyor. But we fear that for a long time to come this will be a fruitful source of difference, which we are not sanguine enough to suppose will cease to breed many a lawsuit.

SKEW BRIDGES.*

WHAT is an oblique bridge? To this natural, and indeed necessary, question, the treatise of Mr. Buck does not supply any direct answer. It is true that by a study of the drawings a general idea may be obtained, by the aid of which the text will gradually yield its meaning to the student. But for a professed treatise on the subject, the first thing demanded either for the literary or for the scientific unity of the work is a statement of the character of the problem which it is proposed to solve, and of the general conditions under which the solution is to be effected.

An oblique bridge, or rather an oblique arch (for there are many cases in which a single oblique arch occurs in an ordinary bridge), is an architectural expedient adopted when the axis of a bridge is not at right angles to the axis of the river or road which it crosses. Thus, if we suppose the case of a bridge 30 ft. wide, which crosses a river, also 30 ft. wide, at an angle of 60° (instead of 90°), it will at once become apparent on drawing a plan that the span of the arch much be upwards of 45 ft. (instead of 30 ft.) in order to clear the channel of the river. In large bridges the difference in cost thus caused by the increase of span is very great. It therefore occurred to the Italian architects, as far back at least as A.D. 1530, that the arch might be reduced in span by being twisted, or skewed, in plan. In a word, while the faces of the arch are built parallel to the axis of the bridge, the abutments are built parallel to the course of the river crossed; and the centre line and faces of the arch are thus at oblique angles to one another.

If, for an arch of this construction, the ordinary mode of building were adopted, and the courses of the brickwork or masonry were laid parallel to the abutments, there would be only a portion of the middle of the work which would form an arch at all. At the acute angle, on each side of the bridge, would be a gradually diminishing wedge of work supported only on one side, which nothing but the excellence of the cement used would prevent from falling as soon as the centre was removed.

To obviate this cause of weakness, the old Italian architects conceived the idea that the courses of the arch should not be laid parallel to the abutment, but (approximately) at right angles to the face of the arch. The mathematical investigation of the elements of the question then showed that each course thus arranged should form a spiral, or portion of a thread of a screw, winding round a cylinder of which the diameter of the axis is that indicated by the angle of skew. By this thoroughly mechanical method of forming the joints, an arch of very considerable obliquity may be made perfectly safe with the minimum quantity of material.

There is an old French work, by Derand, a folio, dated in 1645, entitled "L'Architecture des Voûtes," which contains diagrams of various forms of arch, including the oblique or skew arch. P. Nicholson's work on stone-cutting, published in 1828, is cited by Mr. Buck in his preface as briefly explaining the method of constructing oblique arches with spiral courses. In 1834 it became necessary to investigate the subject for the construction of the viaduct that carried the London and Birmingham Railway over the Birmingham mail-road at Watford. Under the direction of Mr. Robert Stephenson, Mr. Buck, the resident, and Mr.,—afterwards Sir Charles,—Fox, the sub-assistant engineer, devoted much time to the investigation of the subject; and a model, on the scale of an inch to a foot, of the stone voussoirs of a skew arch of 35 ft. span (on the square) at an angle of 55°, was then constructed. So sound were the principles adopted that this model arch, composed of single voussoirs, was perfectly stable, and being held in place merely by a leathern strap, was strong enough to resist a considerable weight. The bridge was afterwards built, the stone voussoirs being wrought in exact accordance with the model, and the lines for the courses of the bricks being traced on the centre by means of a timber scorer and a flexible straight-edge. The central arch, of 35 ft. span, was skew; the side arches, of the same span, were square. There were thus two triangular abutments for the skew arch.

The graphical method employed for setting out this work was detailed by Mr. Fox in a lecture at the Royal Institution in 1835 (or 1836), when the models were exhibited. Mr. Buck published, in 1839, the first edition of the work under notice, of which the mathematical investigation of the formulæ for determining the dimensions and angles forms a conspicuous part. In 1846 appeared the third edition of P. Nicholson's "Guide to Railway Masonry, containing a complete Treatise on the Oblique Arch," edited by R. Cowen. In 1849 was published E. Dobson's "Rudimentary Treatise on Masonry and Stone Cutting, in which the principles of masonic projection and their application to the construction of oblique bridges and Roman and Gothic vaulting are concisely explained."

The chief defect of Mr. Buck's book is the want of that general statement of the case under which the various details may find their fitting place. We say this not in any spirit of carping criticism, but as indicating a very serious difficulty which the student will find in attempting to master the pages. As an instance of this want of method, there are thirteen well-drawn plates, not one of which has any title or legend, nor is there any list or description of them. An "Addendum" to the treatise gives a "description to diagrams for facilitating the construction of oblique bridges," by W. H. Barlow, M.Inst. C.E. But this paper, in which we presently arrive at "directions for using the diagrams" does not refer *nominatim* to any of the plates, and it is not clear whether the following paper, called "Diagrams for facilitating the Construction of Oblique Bridges," refers to any other diagrams than the woodcuts which it contains. Mr. Buck and Mr. Barlow, no doubt, are both fully at home on the subject. But they have both failed to give that simple explanation of what they mean, and of what diagrams they use, without which the student is quite at sea. Mr. J. H. Watson Buck, in his preface to the third edition of his father's treatise, refers to the difficulties encountered by young engineers in understanding it as "chiefly due to inaccuracies in the plates and letterpress." It is to be hoped that he has been successful in removing these; but we think that the chief difficulty is the want of lucid arrangement, and, so to speak, staking out the country covered by the work.

The real key to the practical setting-out of a skew bridge is the division of the centre line of the arch, and of the imposts, as indicated (very indistinctly) in chapter v., and the application of the flexible straight-edge, or, as it is here called, the twisting rule, to draw the lines of the courses on the centre. For dressing the quoins, the sliding template, which is the great guide of the mason, is represented in plate 5. But we do not find any description of that most essential of all the appliances required for practice. Our own experience is to the effect that mathematical formulæ, such as those in chapter ii., are little more than scientific trifling. No formula will enable the engineer to dispense with a drawing. On the other hand, if he makes a good drawing, it is difficult to see what he wants with a formula. What he really requires is full information as to the mode of making the templates for the mason, and as to the simple principle on which to teach the latter to apply them. But this is just what we do not find clearly stated in the book before us. Half or a quarter of the mathematics there displayed would have been ample for a practical treatise, if there had been a few plain and simple directions for the conversion into practice of the theory of the spiral joint, which is the essential element of the skew arch. The sliding template is the clue to the work, and the first thing that the writer on an oblique arch should do is to teach how this appliance is to be made, and how it is to be used.

* A Practical and Theoretical Essay on Oblique Bridges, by G. W. Buck, M. Inst. C.E. Third edition. London: Crosby Lockwood & Co. 1880.

A TUNNEL THROUGH MONT BLANC.

THE French Government has for some time past been contemplating the construction of a great railway tunnel which should bring Paris and the northern parts of France, and, therefore, Great Britain, into more direct communication with Italy than is afforded by the existing tunnel through Mont Cenis. The projects proposed include a tunnel through Mont Blanc, and another through the Simplon or the Great St. Bernard. The last of the three has found very few friends, but it appears likely that both the former projects will be carried out.

The projected Simplon Tunnel is 18,507 mètres in length, while that through Mont Blanc is 13,500 mètres. Comparing these with the other Alpine tunnels we find that the Mont Cenis is 12,220 mètres, and the St. Gothard 14,920 mètres long. The Simplon would, therefore, be the longest of all; but this is compensated for by the fact that it is at a much lower level than the rest, the entrance at Brieg being only 711 mètres, and that at Iselle 687 mètres above the sea level. The entrances to the Mont Blanc Tunnel, on the other hand, would be 1,050 mètres at Montquart, and 1,285 mètres at Entrèves, above the level of the sea. The Bardonnèche entrance to the Mont Cenis Tunnel is 1,291 mètres, and that at Modane 1,158 mètres above sea level; while in the case of the St. Gothard Tunnel, the northern entrance at Gœschenen is 1,109 mètres, and the southern at Airolo 1,145 mètres, above the level of the sea. Thus, the Mont Cenis Tunnel is shorter, but 100 mètres higher than the Mont Blanc, while the Simplon would be almost half as long again, but would be 300 mètres lower.

Since the execution of the Mont Cenis Tunnel, the piercing of the Alps or of any other range has become simply a question of time and money. M. Chandon, in his pamphlet, "Le Percement du Mont Blanc," under-estimated the difficulties of the work. But in M. Bérard's *brochure*, "Mont Blanc et le Simplon considérés comme Voies internationales," the estimate of the magnitude and cost of those undertakings was sufficiently correct, and he showed that France could not afford long to do without these means of communication.

Assuming that the work will be done as quickly as the St. Gothard Tunnel, the boring will take 4,218 days' work, or, working at both ends, 2,109 days; that is, nearly six years. The entire tunnel might, therefore, be expected to be ready for use in seven years.

With respect to the cost of construction, it is estimated that, calculating on the experience and basis of the St. Gothard Tunnel, the total sum for the execution of the work would be 45¾ million francs. The St. Gothard cost 54 million francs. In the northern line of approach the cost is calculated for the first two-thirds to be a quarter of a million; the last third, three-eighths of a million per kilomètre. This makes 21 millions. In the southern line of approach, the first third would cost half a million; the second, three-eighths of a million; and the third, a quarter of a million per kilomètre, thus making 40 millions. The other necessary outlay in laying down the line, &c., is estimated at 9 to 10 millions, making the grand total from 115¾ millions to 125 millions. Of this sum, it is reckoned that France would grant 50 millions, and Italy 12½ millions, so that from 53 to 64 millions would have to be raised either by the railways which would be directly or most benefited, or by other means. The lines of approach are far more easy than those connected

with the St. Gothard, though, of course, less easy than those required for the Simplon Tunnel.

By this line the distance between Paris or London and Brindisi would be shortened by 38½ kilomètres; but the greatest benefit France and Italy would reap from it would be the large additional facilities the tunnel would offer for commerce between the teeming populations of those States.

THE ROTHERHITHE BATHS AND WASHHOUSES.

THESE buildings were opened for public use on the 14th ult. Since that date we have had an opportunity of inspecting the buildings, and must congratulate this quarter of London on the possession of such a fine institution. The baths are administered by a body of Commissioners appointed by the Rotherhithe Vestry. The local authorities of the district have conferred a great boon upon the locality by the erection of the buildings, and they have been ably seconded in their laudable work by the architects, Messrs. Geo. Elkington & Son. In February last * we published a view, plans, and sections of the buildings, together with some particulars of the structure. To these we would refer our readers. In the buildings as executed we note that exceedingly good light and ample ventilation are everywhere secured. There are twenty-six first-class private baths for men, provided with enamelled slate compartments, and each having an electric bell for communicating with the attendants. The baths are of the kind known as "Finch's Royal Porcelain," and are provided with Busby's patent valves, which admit either cold or hot water singly, or cold and hot together. The "supply" to the baths does not, as in some objectionable instances, come in through the aperture for "waste." There are twenty-four second-class private baths for men, similar in all respects to the first-class baths, except that the slate compartments are not enamelled, and are unprovided with electric bells. The men's first-class swimming-bath has a very pleasant and cheerful appearance, and is provided with fifty dressing-boxes,—much roomier and better fitted up than is the case at some other swimming-baths in the metropolis. The second-class swimming-bath is the same in all essential particulars as the first-class swimming-bath, and has forty-seven dressing-boxes. Both baths are lined with white glazed bricks and tiles, and have slate paths along the sides and at one end, a channel being provided near the edge to carry off dirty water instead of allowing it to run into the baths. A strong galvanised iron railing runs round the inside of each of these baths, and there are plunging-boards to each; also gratings to catch and carry off any surface impurities in the water, which is continually being renewed, though gradually so, by means of water admitted at the further ends of the baths. On the first floor are the first and second class private baths for ladies, the former being seven, and the latter eight, in number. There is a towel laundry exclusively for washing the towels used by the bathers. This is in the basement of the building. The public laundry is a very commodious and well-fitted-up apartment. Each washer or laundry-woman has a separate compartment for her use, containing a washing-trough, boiler or copper (heated by steam), and a rinsing-trough, with hot and cold water-supply *ad lib.* Each of these compartments is numbered, and contains, as accessories, a shelf, pail, copper-stick, scrubbing-board, and a wooden rack to stand upon. For all these appliances, besides the use of the hydro-extractors, and of the drying-closet bearing the corresponding number to that of her compartment, to say nothing of the use of the folding, ironing, and mangling room and appliances, the charge made is only 1d. per hour. The floor of the laundry is of slate, and the divisions of the washing compartments are of galvanised iron. The charges made for the use of the baths are very low. The institution seems to be highly appreciated, for on Saturday last 1,700 persons availed themselves of its aids to cleanliness.

The engineering works were executed by Messrs. J. & F. May, the washing-machines and mangles being by Messrs. Bradford & Co. The general contractor was Mr. William Shepherd.

Externally the buildings are of white Suffolk bricks, with Portland stone and terra-cotta introduced for some of the principal members. They have a very bright and pleasant appearance. Altogether, the buildings should be seen by all local authorities contemplating the erection of public baths and washhouses.

* See pp. 214, 216, 223, *ante*.

THE NEW FRUIT AND VEGETABLE MARKET.

VISIT OF THE ARCHITECTURAL ASSOCIATION.

THE most recent of the Saturday afternoon visits of the members of this Association to buildings in progress was paid on the 21st ult. to the new London Central Fruit and Vegetable Market, of which we last year gave a view and plan.* The members were very kindly received by Mr. A. L. Gosling, of the City Architect's office, deputed by Mr. Horace Jones, the Architect to the Corporation, to attend for that purpose, and who read the following statement respecting the building,—part of it being substantially the same as the descriptive particulars already published by us:—

The general principle adopted in the arrangement of the plan of the markets is to make the main floor as nearly as possible the level of the Poultry Market, so that the entire range of markets are readily approachable the one from the other. There being a difference of level of some 10 ft. between the road dividing the Poultry Market and the Fruit Market and Farringdon-road, the main entrances to the market are placed,—1, that on the east, opposite the western entrance to the Poultry Market; 2, that on the north, in Charterhouse-street, near the corner of the western roadway; and 3, that on the south, in the southern roadway, in a corresponding position to that in Charterhouse-street.

The floor of the market will be level, a slight gradient being necessary only at the several entrances.

The plan of the market shows an area of nearly 44,000 ft. devoted to wholesale market purposes, surrounded by forty-one shops, fronting the several streets, which can be used for retail or other purposes, and these occupy an additional area of some 16,800 ft.

The general or market area is approached by the main or vehicular entrances, as before stated, and by two further entrances for foot-passengers from the Farringdon-road corners of Charterhouse-street and the southern roadway.

The market consists of a series of shops or stalls, thirty-three in number, having in front pitching stands for goods, and wagon stands, the whole approached by a roadway having a width of 18 ft. always clear for vehicular traffic. In the middle of the market area is a further arrangement of pitching stands, with an area of about 4,400 ft., including gangways. In roofing the market the floor has been kept as clear as possible, the detached main roof supports or columns being sixteen in number, and the clear span of the roof-supports is 47 ft. 6 in. and 56 ft. respectively.

The roofs are of laminated rib construction, with a range of glass louvres at the sides, affording an ample amount of light and air, with protection against sun, and with open-air ventilation and protection against rain and snow—so requisite for a market of this character. The height of these roofs will be 28 ft. to the level of plate, and to ridge of louvres 45 ft., the centre dome roof, with a clear span of 56 ft., rising to a height of over 70 ft.

At the south-western corner of the site is a roadway-approach to the basement, 20 ft. in width, and having a gradient of one in twenty; adjoining this are the clerk's offices and residence, a refreshment-house, and the necessary lavatory and w.c. accommodation for the use of the market salesmen, &c. The basement is arranged with a general area under the market, and two tiers of vaults under the outer shops fronting Farringdon-road and Charterhouse-street, the form of construction adopted rendering it suitable for both market and railway purposes. The construction is of iron, with stanchions 45 ft. and 20 ft. apart respectively, with wrought-iron girders of these spans carrying the floor of the upper market. The general appearance of the building externally will be as similar in character to the other markets as the less expensive nature of the works will allow.

The iron stanchions in the basement above referred to as carrying the market area floor and superstructure are divided into four classes; Class I. being calculated to take a maximum load of 170 tons; Class II., 240 tons; Class III., 285 tons; Class IV., 350 tons; and the main girders resting upon these stanchions vary in weight from 15 tons to 32 tons. Of these main girders the largest upon the works is that stretching across the London, Chatham, and Dover Railway and under the main southern entrance. The weight of this girder is 32 tons, and its length 62 ft., and it is calculated to take a maximum working load of 390 tons. The total weight of ironwork employed in the erection of the market is over 2,300 tons, and the total length of girders would be found to be between two and three miles.

The lattice-girders supporting the main roofs are 4 ft. 7 in. in depth, and have spans of 56 ft. and 47 ft. 6 in. respectively, and the load upon each is from 40 tons to 50 tons. The large roof columns are all of the same section, and somewhat novel in construction, being formed of sections of rolled channel iron, with attached moulded bases. The greatest load upon these is about 84 tons, though their strength is equal to many times this load. The total cost of the building, exclusive of land, will be about 150,000*l.* to 160,000*l.*

This market, like the contiguous Central Meat Market and Central Poultry and Provision Markets, is from the design, and has been carried out under the superintendence of Mr. Horace Jones, architect to the Corporation of the City of London. The contractors are Messrs. Mowlem & Co., of Westminster.

We may add to the foregoing that the contractors for the ironwork are Messrs. Rownson, Drew, & Co. Mr. Beresford is the clerk of the works, and Mr. Morey is the general foreman.

This, the latest of a fine series of markets, will be exceptionally well situated for obtaining its supplies of fruit and vegetables. Surrounded as it will be by good broad roads on all four of its sides, vans from the railways and steam-packet wharfs bringing supplies of English and foreign produce will have much greater facility of access to the new market than they have to the existing Farringdon Market (which latter will be superseded by the building above described), and great facilities will be afforded for bringing produce from all parts of England, north and south of the Thames (and even from the Continent, *viâ* Dover and other ports) by means of the railway. The site of the market is partially over the piece of railway which connects the London, Chatham, and Dover Railway at Snow-hill, with the Metropolitan Railway (and the railways in connexion therewith, such as the Great Northern, Midland, and Great Western) at Farringdon-street. Just to the north of Snow-hill Station four lines of railway sidings converge to the westward, and pass underneath the new market. The work of constructing a new bridge underneath Charterhouse-street, in order to allow these lines of sidings to pass under that thoroughfare and to form junctions with the railway just to the south of Farringdon-street Station, is in progress. By means of these sidings, and by platforms and lifts, the produce will be easily transferred to the market above.

Besides fruit and vegetables, flowers will be sold in the market; but should the market prove to be the great success that is anticipated, it is, we believe, in contemplation to erect a separate flower-market on the comparatively small triangular-shaped piece of ground which will remain unoccupied to the south of the new market, bounded on its three sides by Snow-hill King-street, and the southern roadway.

We have spoken of "Snow-hill," but it is not the Snow-hill of coaching days, although it has a "Saracen's Head" Hotel. The Snow-hill of the present is a broad modern street running nearly parallel with the eastern half of Holborn Viaduct, and forming an easily-graded communication between the high level of the Viaduct at St. Sepulchre's Church with the low level of the Farringdon-road. Just as it is not on the same line as old Snow-hill, neither is the present "Saracen's Head" anything like the hostelry where Nicholas Nickleby made the acquaintance of Mr. Squeers. The "Saracen's Head" of to-day is a red brick building with some architectural pretensions in what has been called the "Free Classic" style, and it stands at the junction of what remains of King-street with the modern Snow-hill.

* See *Builder*, vol. xxxviii., pp. 70, 73.

The Art-Union of London has received an award of the first degree of merit, special, and a bronze medal, from the Sydney International Exhibition, for engravings.

ANCIENT LIGHTS.

ARCHITECTURAL ASSOCIATION.

IN the course of the discussion that followed the reading of Mr. Pownall's paper (printed by us a fortnight ago,—pp. 649-51, *ante*),

The Chairman (Mr. Ernest C. Lee, president) said that while he, in common with the members of the Association generally, must feel greatly indebted to Mr. Pownall for his paper, he was hardly prepared to go the whole way with that gentleman in his proposed reformation of the law of the question,—which, there could be no doubt, had grown up in a very curious and crude manner, and was a source of frequent trouble and difficulty to architects. He was sorry to think that the 45° theory was upset, because it seemed to him to be a very fair rule to go by.

Professor Kerr (being called upon from the chair) said he would give his views upon this somewhat-difficult subject. He would endeavour to give the members a practical idea of what the present state of things was, and an equally practical method of how to deal with it. He would say nothing of those parts of Mr. Pownall's paper which had treated of the origin of the existing law, but would take the law as it stood. He would say, however, that the law of ancient lights was peculiar to England alone. There was no other country in the world in which it would be tolerated, but England was the Paradise of Vested Interests. The practical operation of the law frequently entailed great hardships. When an architect was going to re-erect a building in London or any other large town, he had to look around him very carefully, inasmuch as it was not always that the new building would occupy precisely the same ground as the old one, nor was it very likely that the position of the new building towards lights would be precisely the same as in the old. He had, in fact, to be very careful to discover what ancient lights existed in surrounding buildings, in order to avoid such an assertion of rights with regard to those lights as to practically prevent him from erecting his building. The form which litigation took in regard to rights of light was very unfortunate. The way in which the rights of the owner of any window which had existed in its present condition for twenty years or more were asserted was something like the following:—In the first instance, the owner of the threatened light very likely took fright, thinking that his property was going to be very much damaged. If he did not take fright, he thought that perhaps there was a little money to be made out of the affair. In either case, he more often than not determined,—perhaps by the advice of one of those peripatetic surveyors who looked out for such cases,—to assert what he considered to be his rights. The more he thought over it by day, and the more he lay awake thinking of it at night, the more dreadful did the apprehended injury seem to be. The surveyor told him that he would be placed in total darkness. He went to his solicitor, who told him that there were two remedies at law: he might either go to Common Law or to Chancery. "If," said the solicitor, in effect, "you go to Common Law, you will wait until the injury is consummated, and then you will claim damages in money. If you take my advice, however, you will go to Chancery, and obtain an injunction against your neighbour, whereby he will be unable to build at all, and you will thus get him under your thumb, and he will be compelled to make terms with you." Of course, after such advice, the case went to Chancery. There was, happily, however, one recently-introduced safeguard for the unfortunate defendant in such cases, which was not generally understood, and it took something like this form: The plaintiff, in applying for an injunction, was told by the Court that he should have it, but on this condition,—that if he proved to be in the wrong in regard to the asserted damage he would sustain by the erection of the new building, he must indemnify his neighbour, the defendant, for having stopped his building. In many cases the plaintiff would not go any further, and altogether this condition imposed by the Court in granting the injunction exercised a wholesome check upon vexatious applications for injunctions. If the plaintiff would not give such an indemnity, the Court would not help him, but would say, "We cannot prevent the building going on; but if the building is completed before the hearing of the case, we will take into consideration the idea of making the owner pull down his building if you prove that you sustain damage by its erection." As a matter of fact, a building in such circumstances was not pulled down, and the plaintiff was compelled to be satisfied with pecuniary compensation, which, by the time it had been awarded by the proper legal process, often represented a loss instead of a profit on the transaction,—so that justice was often done by accident, as it were. Supposing, however, the case went on, the cost was something enormous. As an instance, he might mention that two gentlemen in the City, possessed of considerable wealth, engaged in a contest of that kind. After the case had been carried on for some considerable time, one of the parties to the suit walked into the counting-house of the other, and said, "About that question of ancient lights,—I have come in to talk it over with you." They talked it over quietly, and they came to the conclusion that, as men of business and as rational beings, the best thing they could do would be to cry "quits," and each pay his own costs. Each of them paid 1,500*l.* for costs, and the building, of course, remained. It was not merely the prodigious and outrageous loss thus entailed which was the great grievance: it was the total uncertainty of the result of legal proceedings. That uncertainty arose from several causes. In the first place, the law was constantly changing. The judges were so entirely uninformed upon the practical points involved in proceedings of this kind, and confessedly so, that each successive judge who had a case of ancient lights before him looked at it in his own way, and applied his own common-sense to it, giving but little attention to the common-sense of previous decisions; for counsel were easily able to persuade him that the preceding cases and the one which was then *sub judice* did not precisely go "on all-fours." There was thus a continual formation of precedent from year to year. It was considered by the lawyers to be a "development" of the law, but it was not law at all, but a series of contradictions. Lawyers, as Mr. Pownall had indicated, were very fond of direct evidence, and they held science in absolute abhorrence. Mathematics they had heard of, but no more; and they would look at a diagram when it was upside down. But they were very fond of models. Now, a model was the most delusive thing in the world, if the man who made it wanted it to be so. The judge would say, "Well, gentlemen, you know I have had the surveyors before me many times, and I don't think much of *them*. One says one thing and another another thing; therefore, give me direct evidence." A few years ago there was a theatre built in Holborn, parallel to a narrow street called Warwick-court. On the left-hand side of that court, on the same side as that on which the theatre was erected, there was a well-known coffee and eating house, where all the lawyers' clerks used to dine. The old houses which formerly occupied the site of the theatre had been pulled down, and when the theatre had arrived at a certain elevation, the gentleman who carved the beef and ham in the eating-house laid his knife and fork on the table once for all, and declined to carve any longer, because he was "in total darkness." The judge in that case instructed him (the Professor) to look into the case. He found that the theatre had not reached the level of the old houses, although the carver was prepared to swear that he could no longer see to do his work, and other servants corroborated his statements. It seemed to be an easy matter for an employer to get his *employés* to swear to what their master said, and, unfortunately, surveyors could be found to swear to what their clients wished them to swear. The facility with which some surveyors persuaded themselves to give evidence in favour of their clients had always been a wonder to him. Far be it from him to cast the slightest slur upon such gentlemen, but he referred to the curious facility with which they arrived at the views of their clients, and which, he had said, and he repeated it, was not creditable to the profession. These practices were followed on both sides, so that there was no possibility of a layman coming to a decision. Such professional witnesses as he had referred to had no scientific *datum* to go upon; but surely, as professional men, they ought to have everything laid down with precision, and for everything they said in the witness-box they ought to be able to give a reason. He had heard some gentlemen give their evidence in a very offhand way, and when they were asked to give a reason for the statements they made, they said,—"Well, that is my experience." Now, however, the judges would not take that answer: they wanted to know upon what that experience was based. Such conduct as that which he reprehended placed architects and surveyors in a most unfortunate and improper position. A proposal was made the other day by Mr. Roger Smith for dealing with light and air cases by means of references; but Mr. Smith did not pretend to lay down any principle that would stand criticism,—he merely suggested something for what it was worth, just as Mr. Pownall had done. Lawyers must not criticise those proposals, because they were honest attempts to meet a growing difficulty. Mr. Smith's suggestion was that a precedent was afforded by the manner of settling disputes under the Building Act in party-wall cases. But Mr. Roger Smith forgot that in a party-wall the transaction was one of partnership, the party-wall being the joint property of two owners, and therefore the law benignly provided the way for the settlement of disputes. But such an amiable course of proceeding was not possible in dealing with ancient lights; for in ancient lights there was no partnership as between neighbour and neighbour. Mr. Smith's proposal was, therefore, he thought, quite inexpedient and inapplicable. He thought, however, that in cases of damage to ancient lights caused by the carrying out of public improvements, the Legislature might fairly be asked to concede the principle suggested by Mr. Roger Smith of compelling the injured parties to take money compensation for any damage done in the interest of public improvement. Proceeding to speak of the means of ascertaining the damage to ancient lights, Professor Kerr said that the question always put was,—"Is there material damage?" Well, one man swore there was and another swore there was not. The Professor next proceeded to explain, by means of a model and diagrams, his method of mathematically ascertaining the amount of obscuration to ancient lights caused by new buildings, and by which means he was able to arrive at what he called the minimum of necessity. With regard to the angle of 45°, the present Master of the Rolls, who was probably the best judge of such questions on the bench, decided that the rule of 45° should be applied in certain cases. He was taken to task for it by the Court of Appeal, and the next time he had an opportunity he stated his reason for his former decision. He pointed out that the street in question was only 30 ft. wide and the houses were only 30 ft. high. There were, of course, many cases in which a man would be very much injured by the adoption of the angle of 45°. He knew of one gentleman of experience who claimed not only that the angle of 45° vertically should be applied, but the angle of 45° laterally. The reason why reflected light was not taken into account was that it was only in dull weather, and towards the close of the day, that the question of injury to light was raised. It was not raised in the noon-day of summer, but in the afternoon of winter. Practically, reflected light was not worth very much. As to what ought to be done by the young architect who found himself in a difficulty with regard to ancient lights, he (the speaker) would say,—Be most careful to avoid a quarrel. Go to the neighbour, hat in hand, entreat him to listen to your humble request for the settlement of the matter by common sense, and, if you can, induce him to appoint a respectable surveyor to confer with you. That would be doing a very great deal. If men would only reckon the matter up before-hand, have it investigated before-hand instead of afterwards, a great deal of litigation which was very unpleasant would be entirely avoided. Once more, he repeated that his advice to young architects concerned in cases of ancient lights was,—Avoid a quarrel. Go to your neighbour, hat in hand, and ask for justice as a favour. If you stand upon your rights, and say to the neighbour, in reply to his complaint of prospective damage, "Oh, nonsense! I know better! I am not going to do you any harm, but you are trying to swindle us!" the result could not fail to be most unfortunate.

Mr. William White said that as regarded the state of the law on the subject, he thought that some of the evils so clearly set forth in Mr. Pownall's paper most imperatively called for some kind of redress. He did not wonder at the doubts and difficulties by which judges were beset in dealing with these questions, for in spite of the ingenious system which Professor Kerr had devised for ascertaining the amount of obscuration, other eminent surveyors had

differed from him.* Even in respect of the coffee-house carver, there might be good reason for his complaint made as to real obscuration of light, even though the walls had not yet reached their original height. He would refer to this as being an illustration of what he wished to say as to the value of reflected light. It appeared that the street was a narrow one, and if a scaffold were used, say 5 ft. or 6 ft. wide, for the erection of the building, it might reach a third or fourth part across the street, obscuring not only much of the direct light from the window, and casting the whole of the wall into shadow, but taking away the reflecting surface of the ground, and contributing only a succession of dark shadows from the under surface of the scaffolding, and each additional stage would make a serious difference. The room itself, apparently, was lighted almost wholly by reflection; no direct light from the sky could reach it, except a little perhaps upon the floor in front of the window, and any obscuration of the reflecting surface would be a real and tangible loss. He would further say that, with reference to the obscuration caused by the greater nearness of the obstruction, the same observation would apply. He knew that the colour of the reflecting surface could not be taken into account. There was no need for its being so. What he wished to insist on was, that which the Professor denied, that reflecting power from an extended surface or area was of more tangible and substantial value than any possible treatment of the colour-surface, which, on a large scale, would be impossible, and on a small scale of only small value. To take the case of a courtyard of only moderate width. It was popularly supposed that it made practically little or no difference if an obstructive wall were brought nearer to the window, if the height of obstruction were but kept within the same angle of interception with the top of the original obstruction. This was a great mistake. Take the instance of two houses 40 ft. apart, and 50 ft. high. The ground-floor room would be lighted almost entirely by reflected light alone. No direct light from the sky could reach it, excepting just a small patch beneath the window. The only really light part of the room would be found just inside the window on the ceiling, which derived its light from the ground outside solely by reflection and upon which shadows of the curtain-rods and rings were cast. The ground was well lighted from the sky above, and by reflection from the two opposite walls. The room, perhaps, was at best but indifferently lighted, but sufficiently for ordinary use. Now, interpose a wall 15 ft. from the window and 19 ft. high, which would only just obstruct the highest part of the house opposite within the same angle of obstruction, and what was the result? Supposing the room to be lighted, as it must have been, chiefly by reflected light alone, he should estimate that bringing this wall two-thirds nearer would take off two-thirds of that half of the light previously enjoyed.

Mr. T. H. Watson, in moving a vote of thanks to Mr. Pownall for his paper, said the subject of which it treated was one in which they as practical architects must all take great interest. He was pleased that Mr. Pownall, in laying the question before the Association, had taken such a very practical view of it. Nothing could be more disturbing to an architect than to find himself interrupted in his work by the law as to ancient lights. Very frequently he found himself on the horns of a dilemma. He must either involve his client in a law-suit, or surrender all the upper features of his building. He (the speaker) had found in practice that when people found that their lights were about to be injured by building operations, they suddenly set an extraordinary value upon those lights, although, when the history of those lights came to be looked into, it would often be found that the owners had hitherto set very little value on them.

Mr. J. Douglass Mathews seconded the motion. He said the subject was a large and very important one. When questions of light and air went into court, a very great deal depended upon the way in which counsel took up the points of the case and placed them before the judge. The more practice one had in connexion with ancient lights, the more unsatisfactory did the state of the law prove to be. As to the demands of clients, it was his experience that architects and surveyors often had very great difficulty indeed to persuade them that they would not be materially injured by their neighbours' building operations.

The motion having been carried, Mr. Pownall briefly replied, and the meeting terminated.

* Mr. Wyndham Tarn had been called in, in order to combat Professor Kerr's calculation, and to demolish it by a counter-theory of Mr. Homersham Cox's, who had the temerity to come forward to demolish Professor Kerr's.—W. W.

ARCHITECTURAL ASSOCIATION.

AT the ordinary fortnightly meeting of this Association on Friday, the 27th ult., Mr. Ernest C. Lee, President, in the chair, the following gentlemen were elected members, viz.,—Messrs. A. Hemingway, Geo. Havill, F. P. Oakley, T. B. Wilson, F. A. Capper, J. H. Buckeridge, W. R. A. G. Tucker, J. C. Hudson, W. D. Caröe, M. Justin, R. M. Hamilton, G. C. Horsley, and W. T. Burr.

On the motion of Mr. Eales, a vote of thanks was accorded to Mr. Horace Jones, the City Architect, for permitting the members to visit the new Fruit and Vegetable Market* on Saturday, the 21st ult., and it was announced that the next visit would take place on the 11th *instead of* the 4th inst., probably to Greenwich Hospital.

Mr. R. C. Page read the list of officers nominated to serve for Session 1881–82, Mr. Aston Webb being nominated President, and Messrs. G. R. Redgrave and L. C. Riddett, Vice-Presidents. Mr. Page also announced that the annual dinner of the Association would take place on the 16th inst. at the Criterion Restaurant.

The Chairman expressed a desire that all members of the Association who had promised subscriptions to the Association Travelling Studentship Fund would send them in as soon as possible, as it was intended to send out a student this year.

Mr. T. G. Jackson, M.A., of Oxford, then read a valuable paper on "The Use of Marble and Similar Materials in English Architecture." This we hope to print next week, together with some annotations by the author suggested during the discussion as likely to make the paper more useful. We defer our notes of the discussion (which was very brief, the only speakers being the Chairman, Mr. Stannus, and Mr. S. Flint Clarkson) until we print the paper.

* Of which we give some particulars on another page.

RAINFALL.†

THE rainfall of a country, its quantity and variableness, is of especial interest to the engineer, and not only to him, but also to its inhabitants in general. What so fertile a source of conversation is there in England? There are men who are fluent upon the subject of the weather when all other themes fail them, and there are those to whom top-coats and umbrellas are the very spinal cord of their several existences.

The reason why we are so much given to the discussion of meteorological questions is probably owing to the very remarkable position occupied by the British islands upon the face of the globe, and the frequent and rapid changes of climate to which they are subjected in consequence, and which latter are quite sufficient to account for our atmosphere of almost incessant fog. It will be hardly contested that we are a nation of fog-ridden people, and indeed, on approaching England from southern latitudes, the illusion of our being otherwise is somewhat rudely dispelled, for no sooner does the ship's keel cut the chops of the Channel,—it may be even when in advance of that position,—than we find we really must say farewell to the sunshine, the air of crystal clearness, and the deep blue of the sea, and content ourselves with the homely fog and the muddy and lack-lustre waters which encircle us.

But let us be content,—things might have been worse, for is not England in the same latitude as Labrador, whose fiords and coasts are icebound for six months of every year? Whence, then, comes the higher mean temperature that we enjoy? It is due to the diurnal motion of the earth on its axis from west to east (or, as observed from a station at the North Pole, a motion contrary in direction to that of the hands of a clock) causing currents in the opposite direction, that is from east to west, both in the waters and the atmosphere that environ it. These currents are primarily equatorial. The great Atlantic current traverses the great ocean, and impelled by the prevailing atmospheric current, it strikes with its utmost intensity upon the Brazilian promontory of Cape San Roque, latitude 5° south. Here it is divided, one stream flowing south and the other north. The latter, surging amid the islands of the Caribbean archipelago, plunges into the Gulf of Mexico, which no doubt owes its symmetrical circular outline to its action. It finds a difficult exit from this *cul de sac*, in which it is delayed, and charged with a tropical intensity of heat; but move it must, being unceasingly propelled from behind, and so it wraps round the Florida peninsula, latitude 25° north, coasts northwards the shore of the United States, passes Cape Hatteras, latitude 34°, washes into the Bay of Fundy, in its now north-east course, carrying with it a wealth of food for the shell-fish that abound there; and again swinging past Cape Sable until it reaches the banks of Newfoundland. Here, somewhat disabled, it deposits upon the famous banks a portion of its heavy freight of silt acquired during its passage of the various great river *débouches* of the Continent; it then impinges upon Cape Race, and refusing the allurements of the Polar region, it selects for the axis of its direction parallel 50°, or thereabouts; still glowing with the heat received from a vertical sun, and receiving a new impetus from the prevailing west winds, it trends right through the North Atlantic with a distinctly appreciable stream, and in a direction from west to east, be it observed, the very opposite to that of its primal course. Arrived on the opposite side of the ocean, it fairly strikes the British Islands full tilt, is again bifurcated into north and south streams of gentler speeds and force; at the same time warming our skies and our plains, and giving to us that generally salubrious climate which is denied to the denizens of Labrador, while its accompanying stream of warm wind meeting with the naturally chill strata of our normal atmospheres, produces the inevitable results, precipitation, partial or total, as may be.

It is probable that the axis of this ocean stream, moving across the Atlantic, and only held to its course between banks of water, varies at times in its direction, sometimes pointing upon Ushant, then upon the Lizard, Cape Clear, and the Hebrides, which is again a fertile source of variability of climate.

And now a word for the winds. Like the waters of the globe, the atmosphere also envelopes it, and is subjected in many respects to similar movements. It also possesses currents. These we call winds, and their primal directions, like those of the envelope of water, are from east to west. These first exhibit themselves not far from the equator on each side of it, as the north-east and south-east Trades. Like the water-currents, too, they ultimately assume the opposite direction to that with which they started, and are known in the north temperate zone as west and south-west winds. Their direction is very apparent in the case of ships, in the fact that the voyage westward across the North Atlantic is one for sailing-vessels of a month to six weeks; whereas the homeward voyage from America, is one of only a fortnight to three weeks. It is the same way with steam-ships. The homeward voyage is invariably somewhat shorter than the voyage outwards.

The manner in which the easterly winds of the equatorial regions are converted into the westerly winds of the temperate zones is explained in the diagrams. The rarefaction of the equatorial belt of air by a vertical sun causes a vast ebullition in the gaseous envelope, and an extensive radial or upward current. This involves north and south under-currents of air towards the equator to supply the void or vacuum below; the highly-heated and water-bearing air from the equator then passes as an upper current towards the north and south temperate regions, upon which it descends, and, possessing still a considerable portion of its high equatorial velocity, it touches the earth at points where the earth's speed is normally much lower than at the equator, and thus produces the effect of a westerly wind. Those westerly winds, no doubt, pass over Labrador, as they do over the British islands; but in the long ice-bound territory named, having passed across a huge continent, they have been deprived of their heat and moisture by radiation and precipitation, while, as they strike our shores, they are heavily freighted with both the one and the other, and

† A paper read before the Civil and Mechanical Engineers' Society on the 28th of April by Mr. B. Haughton, C.E.

thus we obtain a moister and more genial atmosphere. In short, as a great man has said, in one of the best of his books,—"The English import their corn and all their wine; even their religion is an exotic." He might have added, they import also their caloric, their mists, and their showers.

As a consequence of this westerly flow of both wind and water against our shores, it is our western Highlands that receive the heaviest downpour of rain. Accordingly, the registry of rainfall in the town of Clifden, Connemara, Ireland, indicated as much as 95 in. in the year 1875. Ireland receives the first shock of this double tide directed against these islands, and its climate is proportionately damp in consequence.

Seathwaite, in Cumberland, shows 120 in. in the same year. In 1872, the Stye, at 1,000 ft. of elevation = 244 in. (or over 20 ft. depth of water). Little Langdale, at 385 ft. = 133 in.; Grasmere, at 1,175 ft. = 132 in.; Seathwaite, at 422 ft. = 176 in.

Wales shows, in 1872, at Aberdare, at 634 ft. of elevation = 126 in.; Llanwddyn, head of River Vyrnwy, at 1,740 ft. = 114 in.; Machynlleth = 78 in.; Beddgelert, at 264 ft. = 150 in.

In Scotland, the same year, Firkin, Loch Lomond, shows, at 100 ft. of elevation = 128 in.; Loch Fine = 117 in.; Dalmally, Argyle, at 700 ft. = 143 in.; Loch Katrine, at 830 ft. = 107 in.

From this, and from the rainfall map kindly lent to me by Mr. G. J. Symons, F.R.S., it is demonstrated that it is at our western seaboard, and amid our high mountain-ranges and adjacent to them, that are to be met the heaviest rainfalls; which places, therefore, become the great fountains whence the largest supplies and purest qualities of water are to be obtained for the use of our great centres of population. These places further possess the merit, as collecting-grounds, of having steep watersheds and few inhabitants, the results of which are a minimum of loss by evaporation and absorption, and a maximum of purity in the water.

I have now the satisfaction of placing before the meeting the results of twelve years' registration of rainfall made in London from 1867 to 1878, by myself, involving about 4,500 observations, and the abstracts of which are exhibited in tables A, B, C. They have been regularly and carefully recorded at nine o'clock a.m. of each day, the rainfall entered under each date being that which has fallen during the twenty-four hours previously. This is the method now universally adopted by the 2,000 volunteer observers in the British Islands, who work with and acknowledge the volunteer captaincy of Mr. G. J. Symons, F.R.S., of 62, Camden-square, London.

TABLE A.—*Rainfall in London. Twelve years' averages.*

Year.	Inches Rainfall per annum.	First quarter.	Second quarter.	Third quarter.	Fourth quarter.
1867	26·17	6·25	6 29	9·25	4·38
1868	26·15	6·88	2·67	6·72	9·88
1869	26·43	6 59	6·33	6·48	7 03
1870	20·12	5·94	2·11	4·33	7·74
1871	24·54	4·16	7·08	9·28	4·02
1872	31·53	6·38	7·17	5·74	12·24
1873	23·05	6·03	4·28	7·53	5·21
1874	23·96	2·92	5·66	7·83	7·55
1875	26·48	4·49	5·72	8·16	8·11
1876	23·64	5·28	3·88	4·58	9·90
1877	28·11	8·57	5·65	6·91	6·98
1878	24·83	3·19	9·48	7·30	4·86
	305·01	66·68	66·32	84·11	87·90
Averages	25·41	5·56	5·53	7·00	7·32

Table A shows an average rainfall for the twelve years, 1867-1878, of 25·41 inches annually, and average falls of 5·56, 5·53, 7·00, 7·32 in. for the first, second, third, and fourth quarters of the year respectively. A remarkable feature of the table is the almost exactly equal falls during the first and second quarters, the same being true of the third and fourth quarters.

If ultimately proved to be general, it points to the existence of certain laws controlling precipitation hitherto unnoticed. I shall allude to that point again further on in this paper. A second feature of this table is the rainfall of the second quarter of the year 1868, viz., 2·67 in., with a total rainfall for the year of 26·15 in. This feature is noteworthy when taken in connexion with facts with regard to the exhaustion and inefficient action of several gravitation water supply schemes during this year, as stated in the minutes of evidence of the sixth report of the Royal Commission on Water Supply, 1868-69, viz., those of Liverpool, Newcastle-on-Tyne, Bristol, Manchester, Rochdale, Bury, Preston, Kendal, Bradford, Halifax, Sheffield, and eight other towns of lesser importance; in all nineteen towns.

It will be observed that the rainfall of this year was full,—that is, it was above the average in London, and yet it turned out to have been one of the most calamitous years for water supply ever known in England, and that the lesson for the engineer is to be read, not from an average of three years, as is the practice with some engineers, nor from the rainfall of the driest year, which is taken as the guide by others, for if either of these tests had been adopted, this most fatal year would have been passed by as having afforded a full average supply; but that the true index of the value of a year for its water supply is that of its second quarter, or of the months April, May, and June, in this luckless year giving only 2·67 in. As for the first quarter, it gave nearly 7·00 in., the third gave 7·00 in., while the previous year, 1867, gave a full supply throughout, whereas, in 1868, in Rochdale, Bury, Preston, Kendal, Newcastle-on-Tyne, the reservoirs were absolutely exhausted, and at Bradford, 60,000 of the inhabitants were limited to one day's supply per week for sixteen weeks; in Manchester, the supply was reduced to eight hours per diem for seven days in the middle of September, and at Sheffield there were several reductions of supply, the last being to four hours per diem. In Manchester the supply was limited to the city to twelve hours per diem. On the 3rd of August street-watering was stopped, trade supplies were diminished one-half, and mill-owners on the line of the river had their supplies reduced one-half, and received money compensation for the deficit. The probability is this, that the extreme drought of the second quarter, measured by 2·67 in. of rainfall, so perfectly desiccated the surface of the earth that the nearly full average fall for the third quarter of 6·72 in. was almost if not altogether absorbed.

If I am right, then it follows that in the water gravitation works of the future, if the wants of the public generally, of the traders, and of the municipal authorities, and if the existing privileges of mill-owners, are each and all to be satisfied, the measure of the minimum available supply will be that of the second quarter of the year.

According to these tables, 1870 should also have been a trying year for the reservoirs, as the index quarter of that year shows only 2·11 in. of rainfall.

Referring now to Table B, I have here divided the year's rain into season-falls, of three months each, instead of quarter-falls, as in Table A. The spring season takes the months March, April, May; the summer season June, July, August; the autumn season, September, October, November; the winter season, December, January, and February. The only striking result of this mode of grouping the months is this, that the summer and winter rainfalls are nearly identical, viz.,—6·50 in. and 6·43 in. respectively,—an indication that will, perhaps, take some people by surprise.

TABLE B.—*Rainfall in London. Twelve years' averages, shown in seasons.*

Year.	Inches Rainfall per Annum.	March, April, May.	June, July, Aug.	Sep., Oct., Nov.	Dec., Jan., Feb.
		Spring.	Summer	Autumn	Winter.
1867	26·17	6·37	8·60	5·44	5·76
1868	26·15	3·90	4·13	7·30	10·82
1869	26·43	6·77	3·69	8·12	7·85
1870	20·12	3·58	3·66	6·41	6·47
1871	24·54	5·66	7·85	5·77	4·26
1872	31·53	6·16	7·21	9·69	8·47
1873	23·05	3·58	6·95	7·65	4·87
1874	23·96	2·61	8·36	9·30	3·69
1875	26·48	3.72	8·37	9·32	5·07
1876	23·64	5·06	3·82	6·15	8·61
1877	28·11	6·82	6·90	6·53	7·86
1878	24·83	8·72	8·51	4·15	3·45
	305·01	62·95	78·05	86·83	77·18
Averages	25·41	5·25	6·50	7·23	6·43

Table C gives the annual average monthly rainfalls in London, taken from three different centres of observation. The first is that of the Meteorological Office, and is a compilation extending over a period of sixty years, and which I owe to the kindness of R. H. Scott, Esq., F.R.S. For the second, extending to thirty-eight years, I am indebted to the Astronomer Royal; and the third column shows the results of my own observations for twelve years. This will be found to be, I venture to say, both a useful and a curious combination. From it, it will be observed, that all the three series agree in giving the same degrees of the scale to four of the months, viz., those of October, April, March, February, while the average quantities of rain registered show a close approximation, which fact may be taken as indicating the watchful care with which the registries have been kept, not to speak of the rigid exactitude with which Nature enforces her law of annual rainfall in these particular months, as well as the generally phlegmatic and regular character which they exhibit in performing their annual round of work with so much of trustworthiness and precision.

TABLE C.—*Rainfall in London. Averages in the order of wetness of the months, according to three different sets of observations,*—60, 38, *and* 12 *years.*

	Meteorological Office Compilation 60 Years.		Greenwich Observatory. 38 Years.		B. Haughton, 12 Years.
	In.		In.		In.
1 Oct.	2·74	Oct.	2·87	Oct.	2·69
2 Sept.	2·35	Aug.	2·42	Jan.	2·55
3 July	2·33	July	2·37	Dec.	2·42
4 Nov.	2·28	Nov.	2·27	July	2·36
5 Aug.	2·27	Sept.	2·23	Sept.	2·34
6 May	2·07	Jan.	2·11	Aug.	2·32
7 June	2·00	May	2·03	Nov.	2·21
8 Dec.	1·93	June	1·99	May	1·89
9 Jan.	1·91	Dec.	1·79	June	1·83
10 April	1·65	April	1·64	April	1·80
11 Mar.	1·52	Mar.	1·49	Mar.	1·55
12 Feb.	1·50	Feb.	1·38	Feb.	1·45
	24·55		24·59		25·41

October is the best month of all for the hydraulic engineer, for not only are his payments punctually made, but he is the veritable millionnaire of the months, the most abounding dispenser of the crystalline liquid. Of the remaining eight months, May, June, and July, are sufficiently regular in their several rainfalls delivered; while, as for the five remaining, viz., January, August, September, November, and December, they are eccentric to a degree in their supplies; and, as for January and December, they are the very harlequins of the company.

TABLE D.—*Rainfall in London. Sixty years' averages, shown in decennial periods. Taken from the Meteorological Office Rainfall Registry* :—

Decennial periods.	Inches Rainfall per annum.
1813—1822	25·49
1823—1832	25·12
1833—1842	23·89
1843—1852	24·32
1853—1862	23·78
1863—1872	24·73
Common average...	24·55

Rainfall in ten country stations. Fifty years' averages. Taken from the British Association Report, 1865. *G. J. Symons, Esq., F.R.S.* :—

Decennial periods.	Inches Rainfall per annum.
1815—1824	29·00
1825—1834	28·51
1835—1844	28·28
1845—1854	28·61
1855—1864	26·60
Common average...	28·20

Table D shows the rainfall by decennia periods. The upper half of the table shows the London rainfall for sixty years; the lower half that of twelve country stations for fifty years. Mr. Symons infers from the latter table, which I have copied from one of his pamphlets, that the quantity of the rainfall of England is diminishing, and this, he says, is most perceptible in those districts where subsoil drainage

has been most extensively carried out. To judge from the indications of the upper half, however, it is not so in London. But as the lower, or Symons half, of the diagram is fairly representative of the country rainfall, we must take its indications as showing that there is going on an actual reduction of rainfall in the country districts. Mr. Symons says that this diminution of rainfall is more noticeable on a line of country extending from Cornwall to the Wash, and he adds, "I might further point out that the deficiency seems in some degree connected with the large drainage operations in the Midland and Eastern counties of England." We will all, I think, agree in concluding that such operations as those named ought to occasion a marked reduction of the rainfall. The very extended adoption of the practice of subsoil drainage must eventually declare itself in the registrations of our rainfall observatories, and out of it arises another question of very pressing importance for the hydraulic engineer, viz., that of the largely-increased quantities of water being thrown into the main drains and principal water arteries of these islands. The same complaint is made on all sides, that the sectional areas of these arteries are insufficient to perform the increased work expected of them, owing to the daily increase of subsoil drainage. This is one of the burning questions of the day, as the comforts of social existence are largely disturbed in consequence of the state of affairs; the heavy flood discharges, recognising no law but that of necessity, greatly inconvenience, and occasionally submerge portions of our towns, while at the same time the crops on the farms adjoining such arteries are frequently washed away, and farming operations are hampered and impeded, and generally deranged thereby. Thus both town and country alike suffer, and it cannot be too urgently impressed upon our Parliament that the case demands their earliest and best attention. It will be a subject very difficult to approach, and the adjustment of which will be costly, as these arterial outfalls are absolutely bunged up with mill weirs, privileged obstructions, and various other classes of barriers to the free, downward flow of the water on its way to the sea, the right to remove which must be bought. In some cases it can no doubt be so arranged that the double object of a free flow for the floods, and the preserving of their gravitative force for milling purposes, may be effected; and wherever this is possible, it is only right and consistent with the welfare of the general interests of the country that this double object should receive attention.

If, in the further lapse of time, it becomes certain that the rainfall is measurably lessened, this will cause still greater attention than heretofore to be given to those perennial sources of pure rain water to be found on the mountains of Westmoreland, Cumberland, Perthshire, and Wales; and, looking to the fact of the rapid increase of the population of London, and the positively filthy and impure water-supply upon which its 4,000,000 of inhabitants are at present obliged to depend, and with which they cannot be said to be contented, it is tolerably safe to assert that, before long, some one district of these great western water-collecting grounds will be called on to pour its tribute of the invigorating limpid liquid into the daily widening gorge of the metropolis.

The next table to which I shall ask your attention is that marked E. It shows the average rainfall for every day of the year as deduced from the diagram of the Meteorological Office before alluded to, the observations extending to a period of forty-seven years,—1826 to 1872. I cannot say that it posseses any particular value for the engineer, except in so far as it is of interest to the outsider as well, and therefore in so far as this, that if he has any operation to perform requiring an especially favourable day, he will find here (as far as it is possible to prognosticate in our present knowledge of rain meteorology) the nearest approach to a clue that it is practicable to obtain to the selecting of a favourable one. In this table the rainfall is shown consecutively for each average day of the average year, and it certainly exhibits a few remarkable revelations.

We find that the driest day of the year is March 24th, and the wettest October 22nd, with rainfalls of ·021 in. and ·155 in. respectively. The neighbourhood of the vernal equinox is generally dry; for instance, March 20th shows a fall of ·054; 21st, ·048; 22nd, ·035; 23rd, ·057; 24 h, ·021; 25th, ·042; 26th, ·027; 27th, ·042.

TABLE E.—*Showing average rainfall for every day in the year for forty-seven years, 1826-1872, in London.*

Date. Day.	Mo.	Rain.	Date. Day.	Mo.	Rain.	Date. Day.	Mo.	Rain.	Date. Day.	Mo.	Rain.
24	3	·021	2	3	·052	7	9	·063	15	6	·078
29	6	·022	15	9	·052	8	11	·063	6	8	·078
18	3	·023	2	10	·052	18	11	·063	7	5	·079
26	3	·027	10	1	·053	16	1	·064	21	10	·079
10	4	·027	3	2	·053	24	1	·064	24	7	·080
30	5	·027	15	2	·053	27	1	·064	28	7	·080
18	2	·028	10	6	·053	4	2	·064	29	9	·080
10	12	·028	13	9	·053	16	4	·064	8	10	·080
8	3	·029	15	11	·053	24	4	·064	29	7	·081
29	3	·029	20	11	·053	30	6	·064	30	9	·081
6	4	·029	27	12	·053	8	8	·064	30	11	·081
8	6	·029	14	1	·054	16	9	·064	5	5	·082
8	1	·030	23	2	·054	19	9	·064	17	6	·082
19	3	·030	20	3	·054	5	12	·064	14	7	·082
26	4	·030	25	5	·054	7	1	·065	30	7	·082
30	4	·030	26	8	·054	26	1	·065	6	11	·082
16	2	·032	30	8	·054	20	4	·065	22	7	·083
1	5	·034	28	9	·054	17	7	·065	21	8	·083
22	3	·035	4	11	·054	1	8	·065	12	1	·084
13	10	·035	14	12	·054	3	9	·065	1	7	·084
15	2	·036	22	12	·054	20	10	·065	22	8	·084
3	4	·036	3	1	·055	2	12	·065	1	9	·085
28	12	·036	17	1	·055	18	1	·066	9	10	·085
2	1	·037	23	1	·055	19	1	·066	16	9	·086
13	2	·037	14	2	·055	20	1	·066	26	11	·087
13	4	·037	16	3	·055	22	1	·066	15	12	·087
19	4	·037	7	4	·055	1	2	·066	16	12	·087
12	8	·037	11	4	·055	2	2	·066	30	1	·088
6	2	·038	4	5	·055	31	5	·066	16	7	·088
4	7	·038	6	7	·055	3	6	·066	15	1	·089
7	3	·039	12	9	·055	14	6	·066	2	6	·089
11	3	·039	4	12	·055	10	7	·066	9	6	·089
2	7	·039	17	12	·055	13	7	·066	7	12	·089
15	12	·039	26	12	·055	20	7	·066	28	5	·090
21	2	·040	7	2	·056	5	11	·066	7	8	·090
10	3	·040	18	4	·056	4	6	·067	1	10	·090
6	6	·040	20	12	·056	8	7	·067	21	11	·090
28	8	·040	13	3	·057	23	11	·067	14	3	·091
9	11	·040	1	6	·057	21	1	·068	13	5	·091
3	12	·040	15	6	·057	28	3	·068	16	6	·091
25	12	·040	7	7	·057	2	4	·068	17	9	·091
22	2	·041	31	7	·057	17	5	·068	6	10	·091
2	5	·041	16	11	·057	3	10	·068	24	11	·091
21	12	·041	19	11	·057	1	4	·069	4	10	·092
6	3	·042	23	11	·057	25	8	·069	14	11	·092
25	3	·042	31	11	·057	25	11	·069	27	11	·092
27	3	·042	25	2	·058	1	11	·070	26	2	·093
14	4	·042	3	3	·058	5	1	·071	12	6	·093
21	4	·042	5	7	·058	9	4	·071	7	10	·094
23	6	·043	25	9	·058	3	7	·071	28	10	·094
29	1	·044	11	12	·058	4	8	·071	10	11	·094
17	2	·044	19	12	·058	21	9	·071	10	8	·095
27	2	·044	9	1	·059	22	9	·071	26	8	·095
15	4	·044	1	3	·059	11	10	·071	5	6	·096
17	4	·044	12	4	·059	8	2	·072	29	11	·096
12	11	·044	3	5	·059	24	2	·072	8	5	·097
9	12	·044	11	5	·059	29	2	·072	29	9	·098
24	12	·044	23	5	·059	6	5	·072	11	1	·100
30	12	·044	19	8	·059	20	5	·072	6	9	·100
16	5	·045	11	11	·059	21	6	·072	22	11	·100
26	5	·045	17	11	·059	12	7	·072	2	8	·102
17	10	·045	4	1	·060	31	1	·073	23	9	·103
5	4	·047	6	1	·060	25	4	·073	29	5	·104
11	6	·047	25	1	·060	9	5	·073	10	10	·104
24	8	·047	19	2	·060	12	5	·073	23	10	·104
1	12	·047	24	2	·060	20	6	·073	13	11	·104
12	12	·047	28	2	·060	24	6	·073	11	7	·105
29	12	·047	13	3	·060	25	6	·073	24	9	·105
28	1	·048	8	4	·060	27	8	·073	15	10	·106
12	2	·048	10	5	·060	2	11	·073	24	10	·107
21	3	·048	21	7	·060	19	6	·074	23	7	·108
30	3	·048	18	8	·060	2	7	·074	18	9	·108
27	4	·048	29	8	·060	15	8	·074	18	7	·109
14	5	·048	9	3	·061	14	9	·074	3	8	·109
9	8	·048	7	6	·061	12	10	·074	8	9	·111
1	1	·049	18	6	·061	31	10	·074	9	9	·111
4	3	·049	22	6	·061	11	8	·075	13	8	·112
12	3	·049	20	9	·061	16	8	·075	27	10	·113
4	4	·049	3	11	·061	8	12	·075	28	9	·116
18	5	·049	11	2	·062	19	7	·076	25	7	·118
16	6	·049	20	2	·062	5	8	·076	27	9	·118
14	10	·049	22	4	·062	5	10	·076	30	10	·119
9	2	·050	19	5	·062	23	4	·077	28	11	·121
5	3	·050	27	6	·062	31	8	·077	17	8	·127
15	3	·050	28	6	·062	10	9	·077	23	8	·128
31	3	·050	20	8	·062	11	9	·077	26	9	·128
28	4	·050	7	11	·062	19	10	·077	26†	7	·132
22	5	·050	17	3	·063	6	12	·077	14	8	·132
21	5	·051	9	7	·063	18	12	·077	18	10	·132
15	1	·052	2	9	·063	27	5	·078	25	10†	·132
5	2	·052	4	9	·063	13	6	·078	22	10	·155
10	2	·052									

* Driest day of the year.
† Wettest day of the year.

The period of the autumnal equinox shows for September 20th, ·061; 21st, ·071; 22nd, ·071; 23rd, ·103; 24th, ·105; 25th, ·058; 26th, ·128; 27th, ·118 in.; and points to a heavy rainfall, yet not as exceptionally so, as that of the vernal is dry. New Year's-day shows ·049; May-day, ·034; Lady-day, ·064; Christmas-day, ·040. The average day's rainfall for ten days at the vernal equinox is ·040; perihelion, ·053; autumnal equinox, ·070; aphelion, ·070 in.; the mean of the two extreme sums of the registry being 0·67 in.

It may be said that this table, accurate though it evidently is, as showing the average rainfall for each day of the average rain year for forty-seven years, is but of slight use in foretelling the rainfall for any particular day in the future. In this way of examining it, however, I cannot concur. If we recognise the extreme data of the table, those of the driest and wettest days, as being trustworthy, we must also acknowledge the authority of the figures for those of the intermediate ranges.

I doubt that any engineer, after seeing this table, would select the 22nd of October for the launch of a three-decker, or the cutting of the first sod of a railway, with 0·155 in. of average rainfall; nor do I think any lady would select the same day for a garden party. On the contrary, I should expect that either March 24th, with ·021, June 29th, with ·022, May 30th, with ·027, December 10th, with ·028, or June 6th, with ·029 in., would be much the more likely to be that chosen for the great event.

As a confirmation of my reading of this table, that is, that it is to a large extent reliable, I have taken out all the days from my own rainfall registry (extending over a space of thirteen years), upon which more than half an inch of rain has fallen, amounting to 104 days, and on comparing each day's registry with the corresponding daily average rainfalls as taken from the forty-seven years of observations compiled at the Meteorological Office, I find, as the result of the comparison, what I can only believe to be a very remarkable corroboration of the statement I have made at the outset, viz., that the table may, to a large extent, be considered to forecast the daily rainfall to be expected relatively.

Referring to a remark made near the commencement of the paper as to the strange resemblance of the average first and second quarters' rainfall of my observations (see diagram A), as also the resemblance of the third and fourth quarters the figures being 5·56, 5·53, 7·00, 7·32 respectively, I have to add that this symmetry is not indicated in its entirety by the averages of the sixty years' registry; in the latter the figures are 4·93, 5·73, 6·94, 6·95 respectively.

The question of the quantity of actual rainfall that may be calculated upon as being available for use for the supply of towns with water is a very large one, and one that hardly comes within the scope and objects of the present paper. I may shortly say, however, as to this department of the subject, that Mr. Bateman estimates the total loss of rainfall in wet districts at 8 in. per annum. Mr. G. J. Symons places the loss at 10 in., and at 12 in. for dry districts. Mr. Bateman quotes a rainfall from the English Pennine chain of 50 in. in the driest year, upon which there was a loss of 17 in.

The rainfall calculated for the catchment-basin of the once proposed Loch Lubnaig water-supply scheme for Glasgow was 67 in., on which the loss was 16 in. The Loch Katrine rainfall of average years is 75·72 in., of which 36 in. was assumed to be the minimum available. In Messrs. Hemans & Hassard's proposed water-supply scheme for London, the rainfall is taken at 80 in., with an available minimum of 66 in., showing 14 in. of loss.

Mr. Bateman's proposed Welsh scheme for the supply of London assumes 75 in. average supply of three successive dry years, with a minimum available of 45 inches. He, however, only calculates on 36 in, showing an estimated loss of 30 in. and 39 in. respectively.

I have lately visited the River Vartry Water Works, for the supply of Dublin, where no reliable observations for rainfall had been made previously to their construction. The estimated driest year rainfall was taken at 29 in., with 14 in. available, and 15 in. of loss. This, however, was a considerable under-estimate. They now find they possess a driest year rainfall of 40 in. (1875), and an available 25 in., showing 15 in. of loss.

Chalk is so absorbent that in a chalk country the water yield is very short. According to experiments made at Fields Weir, on the River Lea, a rainfall of 25 in. gave an available supply of only 6 in., showing 17 in. of loss.

With these remarks I shall conclude this paper, at the same time expressing the hope that the day is not distant when the abounding rainfall of our western mountain districts shall be caught at the most favourable points, impounded, and ultimately delivered, a pure unsullied crystal river into the midst of this majestic London, of whose excellence, and beauty, and health, and cleanliness we are all proud, and whose continued advance in the direction of the limited perfectibility that is possible we most earnestly desire.

New Prison for Glasgow.—Messrs. J. & D. Meikle, builders, Newton, Ayr, have accepted contracts Nos. 2 and 4, for the erection of a new prison at Glasgow, the amounts of which are 7,000*l.* and 28,000*l.* respectively.

GLASGOW MUNICIPAL BUILDINGS COMPETITION.

THE Glasgow Town Council have determined to invite a preliminary competition of sketch designs open to all; to appoint an architect to advise in the preparation of conditions, and afterwards an architect or architects to select not fewer than six nor more than ten of the competitors to prepare mature designs, each receiving 150*l.* to cover expenses. From these, four are to be selected in order of merit, and the author of the first is to be employed to carry out the work on the usual professional terms. There is to be no restriction as to style, but a preference will be given to Classic. The cost is not to exceed 250,000*l.* Plans for the internal arrangements, by Mr. Carrick, are to be obtainable on payment of 1*l.* 1s.; but competitors may depart from them if they think fit.

Following out the resolutions arrived at, Mr. Carrick, the City Architect, and Mr. Charles Barry have since been appointed to prepare the conditions for the new competition, and submit them for the approval of a committee who have been fully charged with the conduct of the new competition. The conditions are to be based on the formula of recommendations sent to the Lord Provost a short time since by the Council of the Royal Institute of British Architects, and similar ones also sent him by the Council of the Glasgow Institute of Architects. These conditions are in general conformity with the resolutions recently adopted at the Conference of Architects.

FLORENTINE CARVINGS IN LONDON.

THE library in the mansion now nearly completed for Mr. Leopold de Rothschild in Hamilton-place, Piccadilly, is fitted up in walnut and lime wood, elaborately carved from ceiling to floor. The work was designed by the Chevalier Rinaldo Barbetti, of Florence, and was executed at his establishment there in the short space of nine months. The room is of an irregular shape, and measures 24 ft. 8 in. by 22 ft. 4 in., and has its principal access from the dining-room. On entering the library from the latter, we have on the right an important chimneypiece,—in front a large window, and on the left two French windows, leading to a loggia that looks on to the garden. The style is that of the Renaissance. The mouldings of the bookcases, doors, cornice, and soffit are all done in Italian walnut, whilst the decorative and ornamental carvings are in limewood, having a white creamish colour, and presenting at present a contrast somewhat too strong.

The bookcases are seven in number, and have in the upper part twenty-six pilasters, the inner part of which is in limewood, exquisitely carved with minute and fanciful designs, consisting of figures, animals, birds, leaves, flowers, architectural and ornamental subjects. The design of each pilaster is different from the others in its details, so that there is a wonderful variety in the motives and subjects represented, although the general outlines of each pilaster are, of course, in harmony with the rest. The caps of the pilasters have also different designs, and are varied in the details.

The lower part of the bookcases is enclosed with doors having carved panels in lime, with designs of figures, leaves, and ornaments, and in the lower part of the bookcases are pilasters in lime, carved, representing sprigs of trees and plants, with insects.

In the intervening spaces between the bookcases, windows, doors, and chimney, instead of paperhangings or silk stuffs, the walls are covered with five large panels carved in limewood, which represent Europe, Asia, Africa, America, and Australia, personified by female figures, each bearing attributes, and surrounded by animals, fruits, &c., peculiar to each country.

Above the bookcases are friezes in limewood, with carved Cupids and ornamental designs. The large panels and all these friezes have the background gilt in dead gold.

The chimneypiece stands 7 ft. 6 in. high, projecting from the sides about 3 ft.; in the inside there are two niches, one on each side, with a seat; each niche has a panel, carved, one with a figure representing "Tragedy," the other "Comedy." Above the canopy there are the arms of the Rothschilds carved in limewood, surmounted by the Bible; on the sides of the arms are, in full relief, two Cupids sitting, carved in walnut, and in front of the canopy are two sleeping Cupids, in walnut. Over the mantel are three *bas reliefs*, in walnut, the centre representing "Apollo and the Muses"; the sides have two female figures, one representing "Steam," and the other "Electricity"; on the left side of the chimneypiece there is a door leading to the grand staircase, and which has, above a square frame, a panel having a carved *bas relief* representing "a group of Cupids reading and studying." Over the principal door there is also a large square shield, in limewood, beautifully sculptured and ornamented, bearing the following inscription in raised gilt letters:—

VETERUM
RECENTIUMQUE
SCRIPTORUM
VOLUMINA
HEIC ASSERVANTUR
VERENS
TANGE LIMINA HOSPES.

Between the caps of the bookcases are small square shields in limewood, each with a Latin or Greek quotation from the classics.

The cornice has large panels, tinted in light blue colour, and a raised stud in walnut in the centre; under the cornice runs a frieze, in which are fifty-three ovals, having each a recumbent figure carved in lime; these figures are all varied in design, and are intended to represent the sciences, arts, virtues, and so on.

Some thirty men were employed in the work, comprising carpenters, joiners, and wood-carvers, and the cost, we are told, will be about 4,000*l.*

We should be glad to hear that an opportunity could be afforded to the working wood-carvers of London, some Sunday afternoon, for example, to examine the room and form their own judgment as to the position of their art abroad and at home.

THE FENCHURCH-STREET STATION ENLARGEMENT.

THE works in connexion with the enlargement of the Fenchurch-street Railway Station, which is being extended eastward as far as the Minories, are making rapid progress, and when completed the area of the station will be almost double its present size. A large number of houses, situated between the eastern boundary of the station and the Minories, have been swept away to clear the ground for the enlarged station, which will absorb the whole of what was formerly known as Gould-square, and a large portion of Cooper's-row and John-street. The extension includes the erection of an entirely new block of station buildings in John-street, having a frontage to that thoroughfare of upwards of 80 ft., and five stories in height. There are three entrances to the building, two of which are approaches to the booking-offices, from which the railway platforms above will be reached by flights of stairs. The other entrance, at the east end of the block, leads to the upper floors, which will contain general offices for the use of the Great Eastern, London and Blackwall, and London, Tilbury, and Southend Companies. There will thus be two distinct sets of booking and general offices for the companies interested. This portion of the works, which has been carried out by Messrs. Perry, of the Tredegar Works, Bow, has already been completed.

From the eastern boundary of the existing station to the Minories the line is being widened to the extent of 50 ft. In carrying out this part of the works the whole of the old bridge crossing over Cooper's-row is to be taken down, and an entirely new bridge, widened to the extent above stated, is to be erected. The erection of this bridge is now in progress. It will be carried on strong iron girders and outside box-girders, an immense main girder of 118 ft. in length, which will form part of the bridge, crossing over Crutched Friars and Cooper's-row at the junction of those thoroughfares. The contractors for this portion of the works are Messrs. Bangs & Co.

From this bridge the enlarged station is carried forward, in the direction of the Minories, on eight arches of 30 ft. span each, with central arches extending the entire length to the Minories, which will admit of the entrance of vehicles, and the utilisation, for general business purposes, of the ground-floor space within the arches under the railway level above. The piers of these arches are 4 ft. 6 in. thick, and are built of blue Staffordshire brick, and wire-cut yellow brick, supplied by the Aylesford Brick Company, the mortar consisting of equal parts of ground brick rubbish, and the best lime. The whole of the works have been designed by Mr. A. Langley, engineer-in-chief of the Great Eastern Company, and are being carried out by that company as lessees of the London and Blackwall line, who are the owners of the station.

OLD SALISBURY WORKHOUSE, THREATENED WITH DEMOLITION.

ABOUT a year ago the antiquarian world was shocked at an advertisement issued by the Town Council of Salisbury offering the ancient building, which had for some time served as the city workhouse, for sale, with the condition appended that the purchaser should pull the building down, and erect something new on its site, setting it back so as to allow of the street being made wider, and a new bridge being erected.

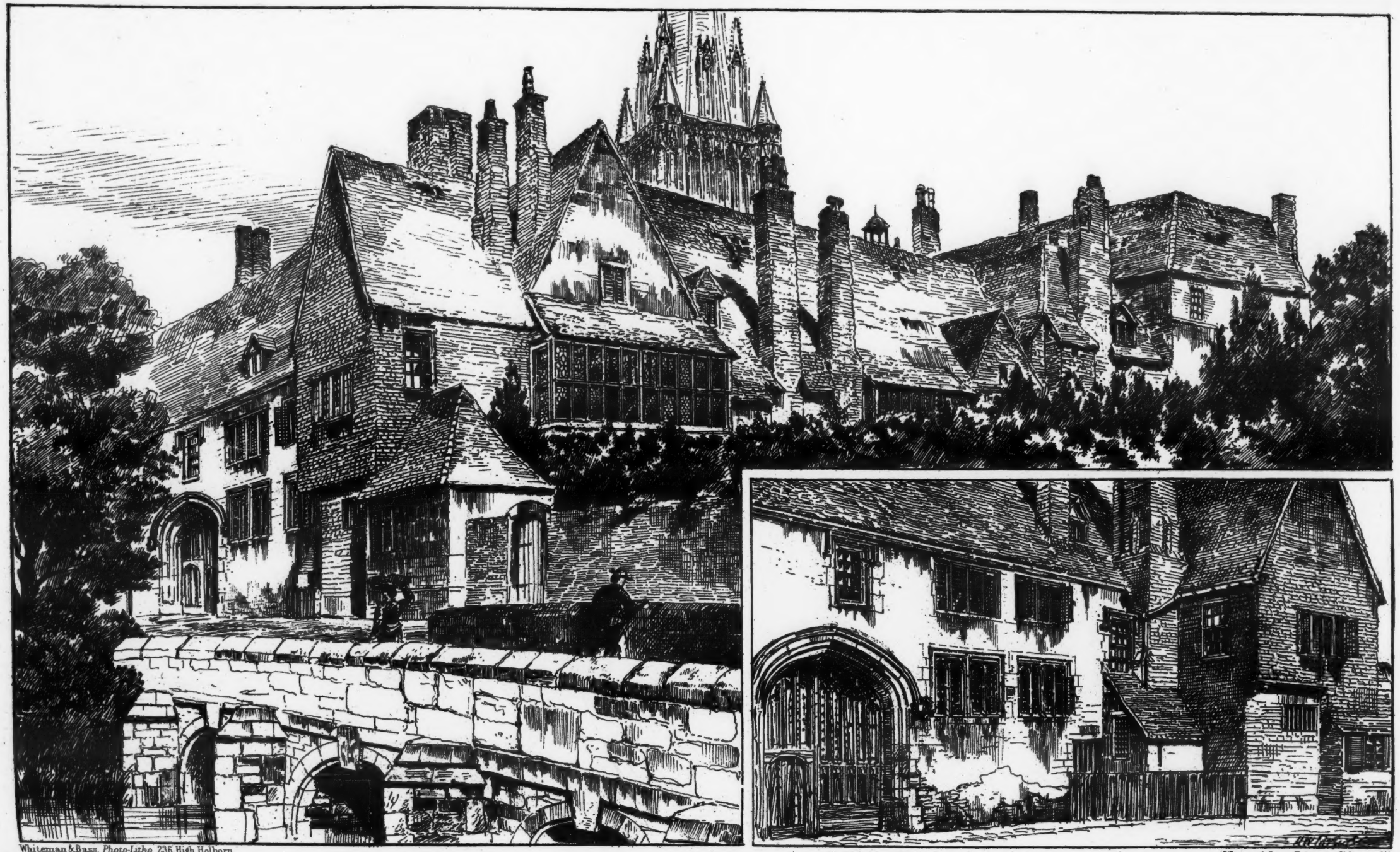
"Audley House," or The Old Workhouse at Salisbury, was erected during the fifteenth century by one of the Audley family, but it is not quite certain which. There is a bishop of the name buried in the cathedral, and another of the family was executed in the reign of Edward IV. After going through various changes the structure at last became the City Workhouse, and continued to be used until some three years back. The buildings surround three sides of an irregular quadrangle. That which faces the street is the most ancient, and evidently dates from the fifteenth century. (See sketch.) On this side is the chief entrance, beneath a well-proportioned four-centred arch, well moulded. The old oak doors still exist, and are valuable examples of Perpendicular panelling. The windows in this portion of the building are square-headed, with cinquefoil cusped lights. They give light to what was formerly a very elegant hall, but which has been injured by being divided into two stories. The oriel window of the hall looks towards the court-yard, and forms a pretty feature. The kitchen is at the end of the hall, with the solar above it. The latter is lighted by a large bow-window looking over the garden in the direction of the river. It contains an original Perpendicular mantel-piece, and has a good plaster ceiling of a somewhat later date. The windows contain much of their original glazing, and a little stained glass.

The buildings facing the river are of later date than those already described, and were probably erected at various times between the reigns of James I. and Charles II. They are remarkably picturesque, and the grouping of gables, chimneys, and roofs, all crowned by the distant spire of the cathedral, makes up a very pretty picture. In the angle formed by the hall building and the projecting gable of the kitchen is a little pent-house structure, which conceals from external view a very remarkable feature. It is a square-headed opening, divided into two lights, the heads of which are treated in a very different manner. The spandrels of one light are pierced by trefoils, but those of the other are filled in with boldly-carved foliage. The whole is very richly moulded. What this curious feature can have been it is at present difficult to conjecture: it seems too low down for a window, and too high for a doorway; it is not in the right position for a buttery-hatch. When the brickwork with which it is at present blocked up is removed the difficulty may be solved.

We are glad to hear that there is some chance of this curious and interesting old building being preserved from the destruction which threatened it, as it has been purchased by a member of the cathedral chapter, who is anxious to utilise it without pulling it down and rebuilding it. We have not yet heard whether the Town Council have abandoned their scheme of widening the street and rebuilding the bridge, and until this is settled the fate of the old building hangs in the balance. It is, however, to be hoped that the people of Salisbury will do all in their power to preserve this interesting relic of antiquity. It would be quite worth while to divert the new street a little, so as to accomplish so desirable an act.

REFERENCES.

1. Bay-window of hall, from court.
2. Interior of solar.
3. Chimneypiece of solar.
4. Carved window or door-head to hall.
5. Section of same.
6. Arch-mould of great doorway.
7, 8, 9, 10. Woodwork of great door.



Whiteman & Bass, *Photo-Litho.* 236, High Holborn.

Wyman & Sons, Printers, Gt Queen St.

OLD SALISBURY WORKHOUSE.

Whiteman & Bass, *Photo-Litho.* 236, High Holborn.

OLD SALISBURY WORKHOUSE.

New Premises Pall Mall Alexander Peebles F.R.I.B.A. Architect A.D. 1881.

Whiteman & Bass, *Photo-Litho.* 236, High Holborn.

Wyman & Sons, Printers, Gt Queen St.

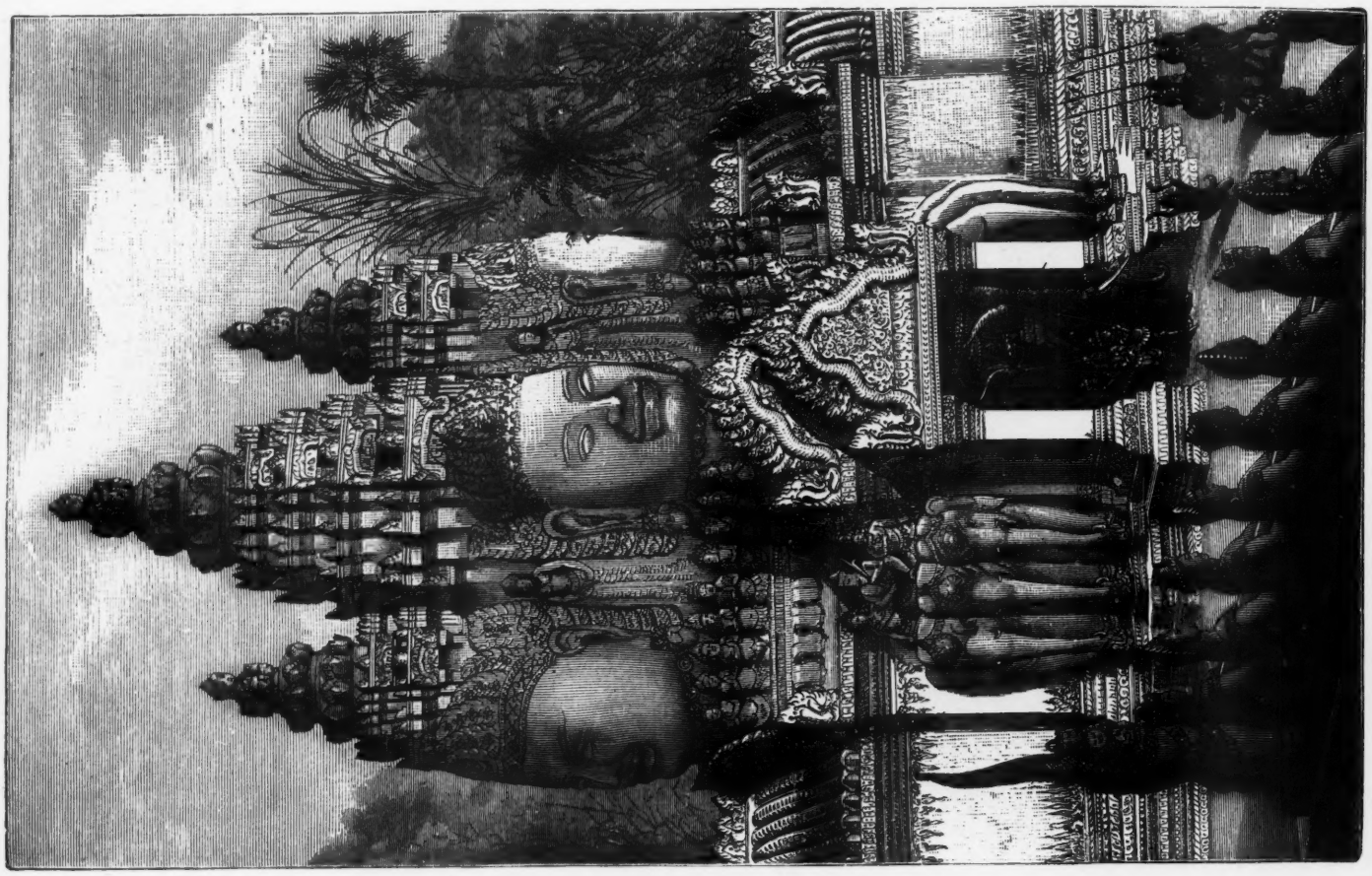


Fig. 2.

THE ARCHITECTURE OF CAMBODIA.

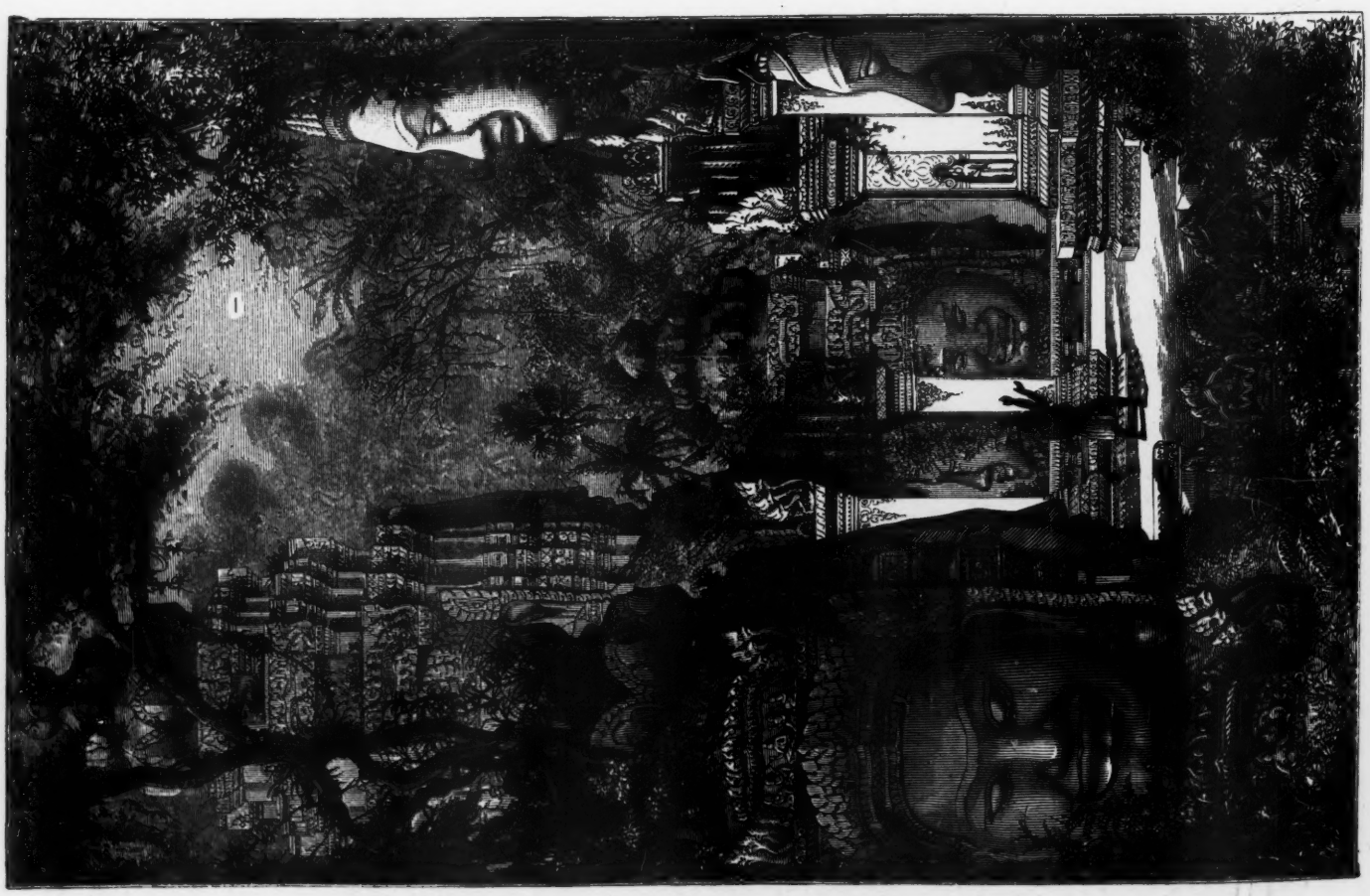


Fig. 1.

THE ARCHITECTURE OF CAMBODIA.

Fig. 1.

Fig. 2.

Fig. 3.

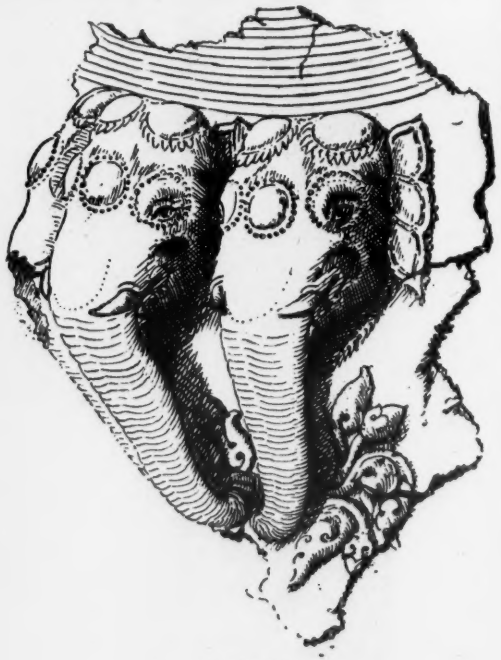


Fig. 7.

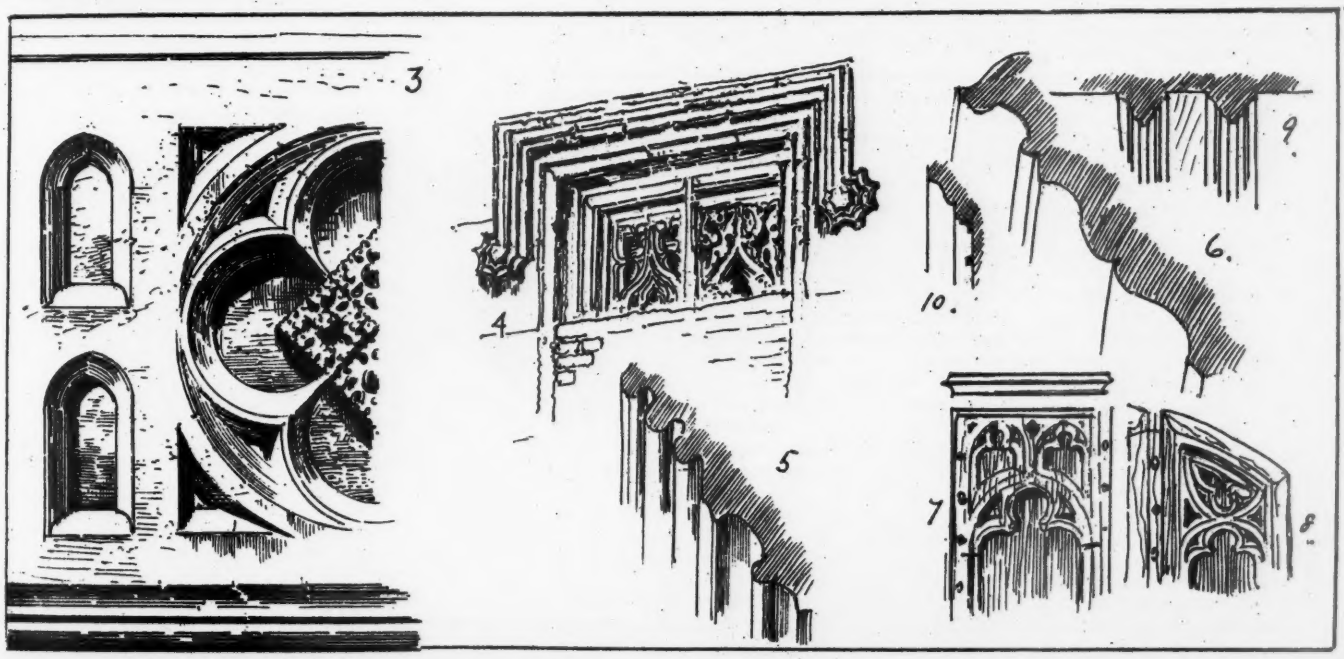
Fig. 5.

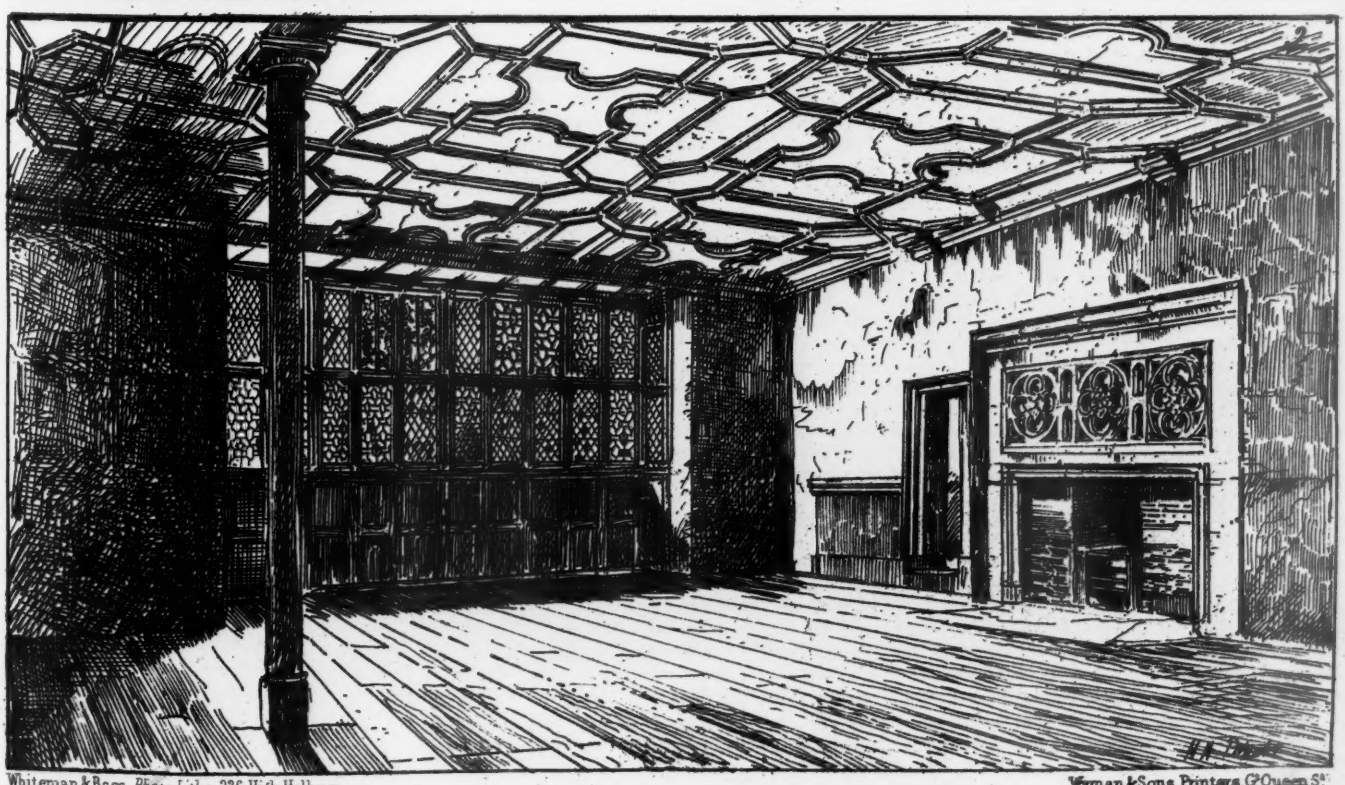
ORNAMENTAL DETAILS FROM CAMBODIA.

Fig. 6.

Fig. 4.

[See p. 689, *ante*.





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OLD SALISBURY WORKHOUSE.

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PREMISES FOR THE LIFE ASSOCIATION OF SCOTLAND, IN PALL MALL.

OUR illustration is taken from the drawing of these premises which is in the present exhibition of the Royal Academy. The site, which is opposite to Her Majesty's Theatre, possesses a frontage of 54 ft., and continues through to Warwick-street, where it has a similar frontage, the former premises being numbered 122, 123, and 124, Pall Mall. The offices of the Life Association will be approached through the portico entrance, and the shops upon either side will be let off,—for the present, at all events,—but provision has been made for incorporating them with the offices of the Association when desired. The upper portions of the premises will be separated from the lower by fire-resisting floors, constructed by Messrs. Dennett. Special provision has been made for the drains, which will be laid in subways, and are to be ventilated upon Banner's system. Flues or shafts are also provided to contain the various water and gas pipes and wires.

The façade is of Whit-bed Portland stone, upon a plinth of finely-axed Aberdeen grey granite, which has been supplied by Messrs. Fife, of Aberdeen. Mr. Morter, of Stratford, E., is the contractor for the works; the sculpture has been entrusted to Mr. Plows; and the architect is Mr. Alexander Peebles, F.R.I.B.A., of Salters' Hall-court.

SANITARY PLUMBING.

JOINTS AND PIPE-BENDING.

MR. S. STEVENS-HELLYER delivered the second lecture of this course (under the auspices of the National Health Society) on Wednesday evening last, in the Hall of the Society of Arts, which was as crowded as on the occasion of the first lecture, which we reported a fortnight ago.*

Proceeding to speak firstly of joints and joint-making, the lecturer observed that although the Americans had invented machines to help everybody as well as the plumber, they had not yet invented an apparatus for making wiped soldered joints. They had, however, invented a machine for uniting lead pipes of small diameter together by what were called "welded" joints, but that mode of union was inferior to a wiped-soldered joint. Joint-making might be called the *Alpha* and *Omega* of the plumber: it was, so to speak, the staircase which took him to the various rooms in the house of plumbing-knowledge. But no man without considerable practice could accomplish it. Some plumbers, though they made joints daily, never learned how to make a perfect joint. There was always something the matter with the joints made by such workmen. They were either "gouty" or "potatoey," too light or too heavy, too dumpy or too elongated, and flat at the sides. They were in no way symmetrical, and their want of rotundity was very observable. Asking the good joint-wipers who were present to bear with him, for the sake of the less-initiated, the lecturer proceeded to enter into the rudiments of joint-wiping and joint-making. In preparing the ends of the pipes to be connected together, either in a vertical or horizontal position, it was very important that no burr be left on the edge of the inside pipe. The burr left on the inner edge in rasping off the outer edge should be taken off with a shave-hook, or the roughness would be liable to catch hair or similar substances passing through a soil or waste-pipe. The end of the outer pipe should be well opened to allow the inner pipe to enter about ¼ in. or ⅜ in. without contracting it in any way. The outer edge of the outside pipe should be rasped off, in order to get a greater thickness of solder upon the joint, without increasing its external size. In soiling the ends of the pipes the workman should soil over at the same time,—or, better still, after the ends had been shaved,—the inside of the inner pipe, so as to prevent the solder running and adhering to the edge, brightened by shaving off the burr. Having described the means of getting a true ring round the pipe for the shaving-line, the lecturer referred to the necessity of exercising care in shaving, so as not to dig the shave-hook down into the lead, especially at the outer edges, as it would weaken the pipe where there would be no thickness of solder to strengthen it again. All that was wanted was to take off the dulness of the lead to enable the solder to readily tin upon it. When joints had to be made in pipes in their positions, the ends of the pipes should be tinned upon the bench before the pipes were put into the places they were to occupy, so as to prevent any foreign matter, such as brick-dust, mortar, &c., getting between the solder and the pipe, and also to ensure the end of each pipe being well tinned. In jointing, especially in all soil, waste, or drain-pipes, the end of the inner pipe should always go with the stream. In other words, the edge of the inner pipe of the jointing should never be fixed against the current, inasmuch as it would form a ledge for the accumulation of filth. Solder for upright, branch, and flange joints, and for sink and cistern-wiping, should be a little finer than solder for making underhand joints. When the solder was found to be too rich for making underhand joints, a little soft pig-lead should be put into it, but not lead pipe or new cuttings, for such lead might not be pure. When the solder was got to be just right for easy use, the solder-pot should be kept solely for making underhand joints, to avoid further bother or loss of time. Another solder-pot should be got for general work, and, as the tin wasted by constant heating, the solder-pot used for making underhand joints should be supplied from the richer solder-pot, which latter should be fed from the new "casts" of solder. "Waste not, want not," would be a good motto to put round every solder-pot. In heating the solder over a coal or coke fire, a cover should be kept over the pot to keep the heat from flying off; but in heating it over a wood fire, a large ladle should be put over the top of the solder-pot with its mouth downwards, allowing it to sail over the top a little, so as to catch the flame and turn it inside to assist in heating the solder; but too fierce a flame should not be allowed to fall upon the solder to eat the tin away,—for the tin rose to the surface. The solder should never be overheated, or it would be deteriorated,—and if pockets never had too much "tin" in them, solder-pots were like them in that respect. The workman ought to be able to tell the right heat by taking out a ladleful, and holding it near his face, or even by passing the back part of his hand over it. A piece of wood was a very good indicator: if a stick when dipped into the solder smoked, the solder was ready for use. In making an underhand joint, the molten metal should first be poured on the soiled parts of the pipe to get the pipes well warmed. Then a dribbling stream should be poured upon the shaved parts of the pipes to be united, which should be well tinned by pulling the solder round and round with the solder-cloth. The workman should keep on pouring out the metal, and let it flow in one continuous stream round and round on the outer edges of the tinning, at the same time working the solder towards the centre part of the joint, and bringing the solder from the bottom to the top. After manipulating it in that way for a minute, and directly it was of one consistency and in a "teachable" mood, the joint should be wiped, and the solder coaxed round and round to get the joint symmetrical. If the workman preferred to use the iron, he should see that it was well cleaned, and just red-hot before using; then when he had got a nice body of solder on the intended joint, he should rub the hot iron round and round it, and take it all off on the cloth, rub the hot iron upon the solder, and work it up into a nice consistency upon the cloth, forming it all the while into the shape somewhat of a sausage-roll; he should then quickly place the centre part of the solder against the under side of the pipe, and turn up the outer half on the off-side, bringing the hand back quickly to turn up the other half on the near side. When this was done, the joint should be wiped with all the dexterity which the workman could command. Of course, these remarks applied to underhand joints upon small pipes. In making an underhand joint upon large pipes, there would be no difficulty in getting the solder to stay upon the upper sides of the pipes: the difficulty would be in getting it to adhere to the under sides, where it had a tendency to drop off in lumps directly the pipes got nice and hot. In making such a joint, the workman should keep moving the solder round and round the pipes, pouring the metal upon the cloth as well as upon the pipes, to convey the solder to the under-side of the joint in a molten state. This should be alternately done on both sides of the pipes during the process of making the joint, and the solder forming round the under-side of the joint should be brought round upon the upper side. When a good bulb of solder was formed upon the pipes, the ladle should give place to the iron, and the joint should be wiped as expeditiously as possible, remembering that one secret of success in wiping such a joint was to keep the cloth following close to the iron. The outer edges, to make a nice clean joint, must be kept well heated with the iron. An over-cast joint was made in the same way as a wiped joint; in fact, it was a wiped joint over-cast with the iron,—*i.e.*, directly the joint was wiped, and while the solder upon it was still hot, a hot iron was drawn up and down over its surface, forming it into a ribbed joint. Over-casting a joint was, however, time wasted, for though it might give additional strength and prevent "weeping" in joints made upon service-pipes when under very great water pressure, a wiped joint was really all that was necessary. In Scotland, joints were only made about half the length of joints made by English plumbers; there was no doubt a saving of solder in this, but there was an absence of beauty in it, and art should count for something. Having described upright joints, and the use of collars to save solder-droppings, the lecturer explained the use of the splashing-stick, and proceeded to speak of branch joints, touching which there were two points which the learner would do well to remember. (1.) Where the branch-pipe was smaller than the main pipe, the solder would rest readily upon the jointing; but where the pipes were of equal sizes, the solder would have a tendency to fall off at the two opposite sides. In jointing such pipes, the catchboard, or whatever the solder was caught upon, should be kept close to the underside of the main-pipe, for the falling solder would not only help to keep the pipe hot, but it would also enable the plumber to dip his splashing-stick into it to supply the place of the falling solder from the sides. (2.) As the lower part of the jointing would be kept well heated by the solder upon it, the solder should be splashed well upon the upper part,—*i.e.*, upon the branch-pipe. The old way of connecting branch-pipes with main-pipes could not be too severely condemned. If plumbers were also joiners, one could understand why the mitre-joint came to be introduced. Such a joint was utterly wrong in principle, and took more time and more solder than were needed to make a properly-formed joint. Having described the block joint, flange joint, taft joint, copper-bit joint, ribbon joint, overcast-ribbon joint, and astragal joint, and the best methods of making them, the lecturer came to the subject of

Pipe-bending.—The plumber could not go far in fixing a pipe,—whether a soil, waste, or service pipe,—without coming across the necessity of turning or bending it to suit localities; and upon the principle of such turning or bending would depend the wholesomeness or unwholesomeness, other things being equal, of such piping (if a soil or waste pipe) after it had been in use for only a short period of time. With bad treatment, and in unskilled hands, lead piping was very stubborn, and would break rather than bend, but in skilled hands it was very pliable, and would bend and turn in any direction required, with the grace with which a swan bent its sinuous neck. In olden times, and even now in some places, it was the practice with many country plumbers, when they wanted to alter the course of a pipe, to cut it and solder it, making an elbow-joint,—a very objectionable thing to do. The bending of lead funnel-pipes (without cutting or soldering them) commenced about forty years ago; but for many years afterwards it was only a plumber here and there, very skilled in lead-bossing, who succeeded in making a perfect bend. There was an art in bending lead-pipes. Many so-called plumbers tried it, but they miserably failed, for in bending the pipe they considerably reduced its strength, especially at the heel of the bend. But that was not the only evil. Unskilled plumbers contracted the tubing in the neck part of the bend often to about half its original diameter. By these defects the value of the piping for its purpose was considerably reduced. In making the bend in a 3½ in. or 4 in. lead pipe (or in any size above 3 in.) the pipe should be well heated by a flame from a gas-jet, or by shavings put inside the pipe, or by pouring some hot lead or solder upon the part to be bent. The pipe should be made as hot as possible,—short of melting it, of course. The workman should then, if it was a long piece of piping, stride over it and press his hand (with a felt or thick cloth under it, to prevent the hand from being scalded) upon the

* See p. 651, *ante*.

pipe where it was to be bent. He should get his "mate" to pull up the end of the pipe, humouring the bending-part as much as possible to keep it in a circular form, to prevent it from crippling. He should then lay the pipe down on one side, and, with two or three sharp strokes of the dresser, dress the bulged part of the piping, from the side facing him, round towards the heel of the bend. He should then turn the pipe over on the other side, and dress the bulged part of the opposite side round to the heel, as just described. By this means he would thicken the lead where it had been weakened in bending it, and he would, at the same time, be giving room for the dummy to work inside the pipe. He should then take the dummy, put it inside the pipe, and get his mate to knock up the neck-part of the bend with the bulb of solder on the end of the dummy, while he (the plumber) was dressing out the irregularities,—dressing the lead ever towards the heel to thicken the lead there. It was desirable not to attempt too much at a time, for to make a good bend, and to make it quickly, several such heats as had been described must be given it. No bend in a pipe should be at a greater angle than necessity required, and no bend was properly made where the lead was in any part reduced in strength below its original substance. The lecturer strongly condemned the use of "bobbins and followers" in pipe-bending. Such appliances would certainly ensure the pipe being kept full bore, but they reduced its strength. The workman who could not bend a pipe properly without using "bobbins and followers" had better "bob" out of plumbing and "follow" some other calling. The lecturer, having referred to some excellent specimens of plumbing work made by the *employés* of the well-known firm of which he is a member, warned the younger men present that, even though they might be or become good joint-makers and good pipe-benders, such acquirements were not enough. They were merely the "three R's,"—the stepping-stones to plumbing knowledge,—the beginning of the path which led up to a mountain height of perfection in sanitary knowledge,—the summit of which had never yet been trodden by the foot of any plumber or sanitarian. In conclusion, the lecturer announced that, in connexion with these lectures, he intended to present fifty copies of his book, entitled "The Plumber and Sanitary Houses," together with prizes in money, to such handworkers (journeymen) who shall produce the best specimens of bent lead pipe, wiped soldered joints, and bossed-up lead breaks; and who shall, in addition, give rough sketches showing the best way of disconnecting soil-pipes and waste-pipes from drains, and of ventilating such pipes to prevent trap-syphonage. The prizes will be awarded as follows, namely:—to the ten best competitors, one copy each of "The Plumber and Sanitary Houses," and 10*s.* in money; to the twenty next best competitors, one volume each of the book and 5*s.* in money; and to each of the twenty next best competitors a copy of the book. Each book will contain an inscription stating how it was acquired. The specimens of workmanship produced in this competition will be used by the National Health Society for awarding the prizes already advertised.

It is not yet decided, but Mr. Hellyer hopes to induce the Exhibition Committee of the International Medical and Sanitary Exhibition (to be held at South Kensington from July 16th to August 13th, 1881) to allow these specimens of plumbing work to be exhibited there free of charge, and to call the locality where they are placed,—"The Journeymen Plumbers' Exhibition Stall." The work should be ready to send in before the 9th of July.

It was further announced that the National Health Society had, since the delivery of the first lecture, received several letters from country plumbers evincing their interest in the lectures,—some of them asking for information and offering to pay their expenses in coming up to London to compete for the prizes offered.

The next lecture will be delivered on the 14th inst., and will be on "Traps and Trap Ventilation."

The New Presbytery attached to the Church of the English Martyrs, Great Prescott-street, Tower-hill, is now in course of erection; it is being carried out from the designs of Messrs. Pugin & Pugin, of Westminster. Messrs. Kelly & Son are the contractors.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

REPORT OF THE COUNCIL, 1881.

THE annual report of the Institute, just issued (and to which reference has been made in previous notices), contains the following passages:—

In making the annual communication to the general body of members, the Council cannot do otherwise than repeat their congratulations of last year. The presidentship of Mr. Whichcord has been accompanied with prosperity, progressively enhanced by the method, determination, and common sense which during two years have characterised the fulfilment of his official duties. In vacating the chair of the Institute, he leaves the corporation stronger and richer than before.

The Council are enabled to record a large increase in the number of subscribing members, and the following comparison with preceding years must be regarded as eminently satisfactory:—

		May, 1878.		May, 1879.		May, 1880.		May, 1881.	
Prof.	Fellows (incl. Life Memb.)	328	639	339	680	353	719	365	787
	Associates.....	311		341		366		422	
Hon. Associates		70		106		114		117	
		709		786		833		904	

Of the 353 Fellows at the last annual meeting, 5 have died, 4 have resigned, and 2 have ceased to be members, while 23 new Fellows have been elected. Of the 366 Associates at the time of the last annual meeting, 2 have died, 5 have resigned, 1 has ceased to be a member, and 6 have been transferred to the class of Fellows, while 70 new Associates have been elected. Of the 114 Honorary Associates at the time of the last annual meeting, 5 have resigned and 8 new Honorary Associates have been elected. The number of gentlemen elected into the three classes of subscribing members during the past twelve months is 101; the net gain is 72. This increase does not include the 83 nominations made on the 28th of March last, nor those, numbering 43, made at the last (eleventh) ordinary meeting. Such nominations, if approved in due course by the general body of Fellows, will make a further addition of 121* new members. Six new honorary and corresponding members have been elected, namely:—M. Charles Lucas, M. Ruprich-Robert, the Chevalier Alphonse de Stuers, the Chevalier Louis de Stuers, M. Émile Trélat, and Mr. William R. Ware.

At the eleventh Voluntary Architectural Examination, which was held during the week commencing 10th of May, 1880, twenty (out of twenty-one) candidates presented themselves. In the Class of Proficiency three passed in both the Scientific and Artistic sections; three (two of whom had previously passed in Art) passed in Science only; two (one of whom had previously passed in Science) passed in Art only. Certificates were consequently presented to Mr. John B. Gass, Mr. F. T. W. Goldsmith, Mr. F. Johnson, Mr. H. H. Kemp, Mr. P. J. Marvin, and Mr. L. G. Summers. The Ashpitel Prize was not given, as the examiners declined to recommend any passed candidate for that award. In the Preliminary Class five gentlemen passed. Cordial thanks are due to the examiners and moderators in this examination for their gratuitous services,† whereby the expense of conducting it was reduced to 23*l.*, the cost of the similar preceding examination in 1879 having reached the sum of 98*l.*

The Council have also to thank the Architectural Examination Committee, appointed at the beginning of the year 1880–81, to work out the details of the scheme for the Obligatory Examination to be commenced in March, 1882, the heads of which were printed in the last annual report. The report of this Committee, submitted after nine sittings, was adopted with only a few verbal amendments by the Council; and at the business meeting of the 3rd of January, the regulations and programme of the Obligatory Examination were approved by the Institute.‡ The examination will be conducted by a board of examiners, consisting of the president, vice-presidents, and honorary secretary for the time being, together with seven Fellows. This board will also conduct the twelfth Voluntary Architectural Examination, to be held in June next, when those gentlemen who have passed in only one of the two sections will have a final opportunity of passing in the other, should they wish to obtain the Certificate of Proficiency; but all new candidates at the June examination will be required to pass in both sections, and at that examination the award of the Ashpitel Prize will be made under the old rules. This prize, which was intended by the donor to be a biennial gift, will, after the 1st of March, 1882, be awarded annually to that candidate in the Obligatory Architectural Examination who, in the opinion of the board of examiners, most highly distinguishes himself in any one of the examinations held during the year. A silver medal has also been placed at the disposal of the Council by Ernest Turner, Fellow, with a request that it may be awarded to the candidate who, during the year 1882, obtains the highest number of marks in sanitary subjects.

The Statutory Examination for a certificate of competency to perform the duties of District Surveyor has been the subject of correspondence with the Metropolitan Board of Works, whereby the Council have been enabled to modify and, they think, improve the character of this examination. Instead of one sitting of four hours for the written examination, there are, under the new rule, two sittings of three hours each, and in the latter the candidate's skill in making working drawings is tested. The oral examination remains as before. A fee of two guineas is now required from each candidate on sending in his formal statement and application; and each candidate, on receiving his certificate, should the same be granted to him, has to pay a further sum of three guineas.

The committee appointed by the Institute in March, 1880, to "take into consideration the subject of architectural competitions, that shall, in concert with other London and provincial societies, suggest certain regulations for the conduct of architectural competitions, and report to the Council the result of their action," have presented their report. It deals, however, with a part only of the subject contained in that resolution, the committee having, it appears, purposely omitted to communicate with other societies until an opportunity could be given to the Council to express an opinion upon the suggestions submitted. Previously to the presentation of the committee's report, certain recommendations were drawn up by the Council for the purpose of assisting the Town Council of Glasgow in framing the "conditions" of a competition proposed for an important building in that city.*

Another resolution of the Institute, passed at the business meeting of the 28th February last, that "the Council be requested to appoint a Committee of Members of the Institute to inquire into the question of the Law of Light and Air, as it affects buildings, and to make such practical suggestions with respect thereto as may seem expedient," has been carried out, and the following members have, in conjunction with the President, Vice-Presidents, an ecretaries, consented to act upon the Committee on Light and Air, namely,—Arthur Cates, Member of Council; G. Somers Clarke, Fellow; E. N. Clifton, Fellow; J. J. Darley, Hon. Associate; W. G. Harrison, Q.C., Hon. Associate; Edward l'Anson, F.G.S., Member of Council; Frederick Ouvry, F.S.A., Hon. Fellow; T. Roger Smith, Fellow; and Locock Webb, Q.C., Hon. Associate.

The Royal Gold Medal has, with the gracious approval of Her Majesty the Queen, been awarded to George Godwin, F.R.S., F.S.A., Past Vice-President.

The work submitted in competition for the medals and other prizes of the Institute show marked improvement in the case of the Tite Prize, gained by Mr. R. W. Collier with a set of drawings good both in design and execution; and in that of the Grissell Gold Medal, awarded to Mr. Frederic Miller. The council have elected Mr. W. R. Lethaby as the Pugin Travelling Student for 1881; and they have much pleasure in stating that the value of this studentship has been increased from 40*l.* to 50*l.* for 1882 and the two subsequent years.

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* Five of the 126 nominations are transfers from the Class of Associate to that of Fellow.

† The Examiners were Professor Lewis, Mr. Penrose, and Mr. Knowles; the Moderators were Mr. Phené Spiers, Mr. Thomas H. Watson, Mr. Pink, and Mr. Stannus.

‡ These were recently printed in the *Builder* (see pp. 593-94).

* These recommendations were quoted in our report of the Conference discussions on Competitions, p. 631 *ante*.

THE GERMAN PLAYERS AT DRURY LANE.

OLD play-goers who remember the care and pains devoted by the late Charles Kean to the getting up of Shakspeare's plays, and who may have been present at Drury Lane on the first night of the German Company's representation, —when Schlegel's translation of "Julius Cæsar" was produced,—would be able to compare their recollections of the effect he produced with those that modern thought and modern ingenuity place at the disposal of the stage-manager. We allude especially to the means of properly lighting the stage. In this respect, the performance of Monday night, at Drury Lane, may be said to have shown remarkable advance; the old foot-lights were all but useless, the effect being, throughout the play, what we used to call dioramic, and it is all but impossible to describe the extraordinary effects this artistic feature added to the play, the figures and the groups moving about, now in shadow, then in full or partial light,—in such a scene, for example, as that of the orchard, in which *Brutus* receives the conspirators, and where at last the audience were delighted with the very fine performance of Fraülein Haverland, as *Portia*, recalled again and again by an excited house. But it is not to Fraülein Haverland, as *Portia*, or to Herr Nesper, as *Brutus*, to Herr Teller, as *Cassius*, or Herr Barnay, as *Mark Antony*, or to any of the single actors that the memory of those present will return so often as to the effect produced by the remarkable training of the supernumeraries.

At this moment we feel as if on Monday night we had actually assisted at the murder of Julius Cæsar, and as long as we live we shall see his regally-draped corse lying in sculpturesque splendour at the foot of Pompey's statue; nor will those present soon forget *Mark Antony's* tone of heartfelt grief over the body of his friend, or the natural acting of *Octavius's* servant, as the young messenger swooned in grief against the marble pillar by the side of the dead emperor.

The architectural scenery is the best that has been seen on the English stage since the time of those remarkable revivals at the old Princess's Theatre, to which we have already alluded.

THAMES BRIDGES.

THE Bill to enable the Metropolitan Board of Works to construct new bridges at Battersea and Putney, to partially rebuild the bridge across Deptford Creek, and to enlarge the centre arch of Vauxhall Bridge by removing the two centre piers and placing girders across the interval, has passed a Select Committee of the House of Commons. The new bridge at Putney will be entirely of stone, erected at a total cost of 406,000*l.*, upon the site of the aqueduct which conveys across the river the pipes of the Chelsea Waterworks, the mains of which company are to be buried in the roadway of the new bridge. The bridge will contain five arches, with four piers in the river, the centre arch having a span of 144 ft., the two side arches 129 ft., and the two land arches 112 ft. The number of openings will therefore be reduced from twenty-three to five, while the width will be increased to 44 ft. The new bridge at Battersea will be simply an iron structure, owing, as was stated before the committee, to the possibility of having to construct another bridge between Wandsworth and Battersea bridges when that neighbourhood becomes more populated. The cost of the new bridge, the position of which will be somewhat to the east of the old bridge, is estimated at 231,000*l.* The width will be increased from 23 ft. to 40 ft., and the number of spans decreased from seventeen to five, the centre arch being 173 ft. wide. The new bridge will be 6 ft. higher than the present bridge, which will allow 15 ft. above Trinity high-water mark. The estimated cost of altering Vauxhall Bridge is 62,000*l.*, and the improvement of Deptford Creek, 12,000*l.*,—which sums, together with the erection of Putney and Battersea bridges, will be contributed to by the whole of the metropolis.

At the meeting of the Metropolitan Board of Works on the 27th ult., the Bridges Committee presented a report recommending that, previously to a contract being entered into for deepening the foundations of Waterloo Bridge, cylinders be sunk, or other protective works executed, at an estimated cost of 1,000*l.*, and that the work be entrusted to Mr. William Webster, at a schedule of prices to be previously arranged by the engineer. Mr. Selway moved the adoption of the report, stating that the engineer had brought this matter before the committee, and had suggested that with a view to economy these cylinders should be sunk, so that he might more carefully examine the foundations and the soil below the foundations before making his final specifications for the contract. The report was adopted.

CESSPOOL EMPTYING BY STEAM.

AN attempt is being made to supersede the clumsy system of cesspool clearing which has been carried on in England hitherto. Our neighbours in France have long since effected this work in a more cleanly manner, and a company is being formed in England for working a French patent. The managing director, Mr. Thos. Lawrie, invited a number of gentlemen last Tuesday to Priory Park, Kew, in order to inspect the machines and witness their working. The plant consists of a van for carrying the 4-in. pipes, which are of various lengths, some made of galvanised iron, others of thick rubber for turning corners; a number of receivers, made of light steel plates, barrel-shaped, and of a capacity of about 3½ cubic yards. They are mounted on framework on wheels, being easily moved by a pair of horses; and a small portable steam-engine, to which is attached a vacuum-pump to exhaust the air from the receivers.

On the ground (which was kindly lent for the experiments by Mr. McShean) was a cesspool ready for exemplifying working. A pipe was pushed down to the bottom of the pool, and other pipes were very expeditiously joined to it until they reached the receiver, to which the end was affixed. The engine was set to work to exhaust the receiver, and the noxious air, not allowed to escape, was burned or purified by fire; directly this was done the sewage rushed up the pipes into the receiver at the rate of about one cubic yard per minute. A glass top was arranged on one of the pipes in order that visitors might see the rapid travelling of the soil. The pool operated upon was of the average English size,—six cubic yards,—and the whole work can be done and the workmen be ready to leave the premises within half an hour.

The plan is the invention of M. Talard, who commenced working it in Paris and environs last October.

At luncheon afterwards, Mr. Robson, architect, spoke of the complete success of the experiments, and the simplicity of the machinery, laying especial stress on the perfectness of the lever-joint fastening.

Mr. Arthur Cates, surveyor to the Woods and Forests, also expressed his appreciation of the apparatus.

The number of cesspools still remaining, and likely to remain, in England is very large, and it is asserted that Birmingham alone is able to boast of 50,000.

UTILISATION OF IRISH MADE BRICKS.

THERE is now in course of erection in Dublin, within a few hundred yards of an old building known as the Temple, upon the Marino estate, once the property of the Charlemont family, Clontarf, the O'Brien Institute, intended for the education and maintenance of fifty orphan boys. The property has been purchased in the Incumbered Estates Court, under the will of the late Miss O'Brien and by the trustees of this benefice of the late Cardinal Cullen. The amount of the present contract is 16,000*l.*, and, besides the usual accommodation necessary for the wants of such institutions, there is to be erected a handsome detached chapel in close proximity to the new building, the cost of which is included in the above estimate. The plans, &c., have been supplied by Mr. J. J. O'Callaghan, architect, of Dublin, and the erection of the building, designed in the Gothic style, is entrusted to Messrs. Hammond, & Co., of Dublin and Drogheda, who are at present actively forwarding the work. The walls are to be of brick, with limestone dressings from the quarries of the contractors at Sheephouse. The bricks, both for external and internal use in this building are of native manufacture, being supplied by Messrs. Thompson, Brothers, from their recently-established works at Kingscourt. The colour of those designed for the outside facing of the walls is of a hue approaching to chocolate. The making of this kind of brick has been but recently commenced. Although the clay found at Kingscourt can be moulded into flower-pots and pipes suitable for agricultural drainage purposes, experiments have yet to be made with the view of fabricating out of the same material the glazed drain-pipe requisites for sewerage works.

PATENT RECORD.*

APPLICATIONS FOR LETTERS PATENT.

2,087. G. Osborne, Brighton. High-pressure regulating taps or valves. May 13, 1881.

2,094. W. N. Bundy, Whittlesea. Apparatus for tuck-pointing walls. May 13, 1881.

2,105. F. C. Jeune, Queen Victoria-street. Manufacture of ornamental embossed fabrics for covering walls. May 13, 1881.

2,131. F. H. F. Engel, Hamburg. Petroleum cooking and heating stoves. (Com. by H. Kock, Hamburg).) May 16, 1881.

2,132. J. Hurst, Brighton. Portable crane for builders. May 16, 1881.

2,133. W. R. Lake, Southampton-buildings. Rotary engines, also pumps and fluid-meters. (Com. by W. H. Jacobs & A. J. Jacobs, Haarlem). May 16, 1881.

2,134. J. Gazeley, Watervleit, U.S.A. Cutting cylindrical cores from natural stones, &c. (Com. spec.) May 16, 1881.

2,135. R. H. Abrey, Highbury. Heating apparatus. May 17, 1881.

2,140. E. Hatton, Manchester. Ventilating apparatus. May 17, 1881.

2,147. W. Bartholomew, Lambeth. Water-waste preventers. May 17, 1881.

2,149. T. F. Shillington, Belfast. Fireplaces or stoves. May 17, 1881.

2,153. J. Sawyer, Middlesex. Register or other stoves. May 17, 1881

2,174. J. Walker, Leeds. Manufacture of bricks, tiles, &c. May 18, 1881.

NOTICES TO PROCEED

have been given by the following applicants, on the dates named.

May 17, 1881.

127. J. Stones, Ulverston; T. Kirby, Barrow-in-Furness; and E. Phillips, Ulverston. Revolving-shutters. Jan. 11, 1881.

137. J. Reffitt & W. Irwin, Leeds. Withdrawing and returning the plugs of urinals trough closets, &c. Jan. 12, 1881.

162. T. Rowan, Ryde. Ventilating buildings, water-closets, &c. Jan. 13, 1881.

243. J. Shanks, Barrhead. Discharge apparatus for water-closet cisterns, &c. Jan. 20, 1881.

717. J. Woodward, Wolverhampton. Self-acting fastener for doors, window sashes and frames. Feb. 19, 1881.

869. D. Edwards, Cardiff. Lifts or hoists. March 1, 1881.

1,352. W. Leggott, Bradford. Regulating fan-lights. March 26, 1881.

1,995. W. R. Lake, Southampton Buildings. Machinery for breaking stones, &c. (Com. by P. W. Gates, Chicago, U.S.A.) May 7, 1881.

May 20, 1881.

248. E. de Pass, Fleet-street. Apparatus for heating by hot water and steam. (Com. by E. Körting, Hanover.) Jan. 20, 1881.

249. E. de Pass, Fleet-street. Automatic heat-regulators. (Com. by E. Körting, Hanover.) Jan. 20, 1881.

403. T. Bate, Kilburn. Ventilating-pots for soil-pipes. Jan. 29, 1881.

1,312. H. Massicks & W. Crooke, Millom. Hot-blast stoves. March 24, 1881.

1,432. W. Morgans, Bristol. Deodorising water-closets. April 1, 1881.

ABRIDGMENTS OF SPECIFICATIONS

Published during the Week ending May 21, 1881.

3,225. L. A. Groth, Finsbury-pavement. Meter for water, &c.

The body of the meter is divided into two horizontal compartments. In the lower one is the meter and turbine, and in the upper one the counting mechanism. The turbine is a disc fixed horizontally on a shaft, having on its periphery notches or cuts forming blades, against which the water is directed in two streams by the injector. The water rotates the turbine, and then passes out at the outlet. The shaft of the turbine actuates the counting mechanism, which consists of several toothed wheels actuating the hands on the dials. (Com. by C. Berhaut and H. Ducenne, Liege.) August 6, 1880. Price 6d.

* Compiled by Hart & Co., patent agents, 28, New Bridge-street, E.C.

3,978. J. A. McKean, Mount Morris, U.S.A. Boring, channelling, cutting, or dressing stone, &c.

The specification, which contains twelve pages of description, fourteen claims, and is illustrated by fourteen sheets of drawings, is not capable of being condensed. Oct. 1, 1880. Price 1s. 8d.

3,991. A. MacPhail, Cannon-street. Kitchen ranges.

The fire-bars are made of a circular form, radiating from the centre, and projecting forwards from the body of the range, by which arrangement the heat is radiated from the entire length of the grate, and roasting or cooking can be done on each side of the fire, as well as in front. The capacity of the grate can be reduced, either vertically or horizontally, and a hinged blower made in three parts is fitted to enclose either part or the whole of the grate. Oct. 2, 1880. Price 6d.

4,006. F. T. Henderson, King's Cross-road. Waste-water preventers and valve-cocks.

Improves valves which have the so-called sucker action, by forming the cups or disc with a cone recess in the bottom, which forms a guide for a peg, forming a continuation of the valve-spindle. On this peg, which has a greater taper than the recess, is fastened the elastic sucker disc. The valve proper of indiarubber is fastened on the underside of the cup. This is all enclosed in a casing; and when a weight is required to hold the sucker-disc down, a ring of lead is employed, with a cross-bar which slides on the spindle. Oct. 2, 1880. Price 6d.

4,013. E. W. De Rusett, Anerley, F. P. Preston, J. T. Prestige, and E. J. Preston, Deptford. Lavatories.

To economise space and effect economy in first cost and in water, the basin is made to turn up when not in use, and the act of letting it down allows a certain regulated quantity of water to flow from the supply-tank into the basin. The slop-container is under the basin, and is also hinged or pivoted to allow of being emptied. October 2, 1880. Price 8d.

4,027. B. J. B. Mills, Southampton-buildings. Apparatus for checking waste of water.

In a cylinder or case, through which the water flows, is a cylindrical valve, which is capable of moving longitudinally in guides. In the bottom of the cylindrical valve, is a valve-port, with a ball-valve of less specific gravity than water, so it will always be in its seat. This ball-valve does not quite close the port. In the valve cylinder is an automatic valve of greater specific gravity than water, and which fits the interior of the cylinder. When water is flowing through, this valve is gradually raised by the water entering the ball-valve port until it comes in contact with and closes the eduction-port of the case and stops the flow of water until the discharge-cock is closed, when, the pressure above and below being equalised, it subsides. (Com. by E. E. Furney, St. Louis, U.S.A.) Oct. 4, 1880. Price 6d.

4,097. H. C. Webb, Worcester. Decorating wood, marble, leather, &c.

A pattern-plate is pressed firmly down on to the surface, and the liquid colours are forced by compressed air through tubes and channels in the plate on and into the wood, &c. Oct. 8, 1880. Price 10d.

4,125. J. Matthewson and G. Tidy, Kilburn. Coal-plates for cellar-openings.

Two spring arms project downwards, each of which has a ratchet tooth, which catches under a shoulder of the fixed frame, and the cover is locked. It can only be opened by pulling down these arms on the inside. Oct. 11, 1880. Price 4d.

4,126. D. T. Bostel, Brighton. Waterclosets.

An improvement on Patent No. 1,412 of 1877, by arranging the forcing trunk at the front of the basin, and the flushing water is admitted at the back through a spout-like arm, and no spreader or fan is required. Oct. 10, 1880. Price 6d.

CASES UNDER THE BUILDING ACT.

INFERIOR BRICKS.

ON the 27th of May, Mr. Charles J. Badger, District Surveyor of Lewisham, appeared before the magistrate sitting at the Greenwich Police Court in support of summonses against two builders for an infringement of the By-laws made by the Metropolitan Board of Works, October, 1879.

The first case heard was that of Mr. Joshua Shuckford, of George-lane, Lewisham, who, it was alleged, had, in erecting a certain dwelling-house, built the external wall of principal front of stocks and place bricks, and not entirely with bricks of the description and quality as required by the 2nd By-law.

Mr. Marsham, after having heard the case and inspected specimens of bricks produced by the district surveyor, decided that place and half-and-half bricks, being imperfectly burnt, were prohibited from being used in the construction of external walls,—which are prescribed in the By-laws to be constructed of good, hard, sound, well-burnt bricks, or of stone, and put together with good mortar or good cement,—and ordered the work complained of to be pulled down.

The second case was against Mr. Charles Whipp, of Engleheart-road, Lewisham, and was of similar character, but applied to four adjoining dwelling-houses. Mr. Marsham again made an order as before.

A Panorama of the Battle of Waterloo has been opened in a building in York-street, near Queen Anne's Gate, Westminster. We shall take an early opportunity of looking at it. The architect of the building is Mr. R. W. Edis, F.S.A.

COLOUR BLINDNESS.

COLOUR, AND EFFECT OF LIGHT ON THE VISUAL APPARATUS.

THE lectures to which we called attention (p. 654, *ante*), on the curious phenomena of colour blindness, bear a close relation to some of those questions of colour which have been recently, and let us say very ably, discussed in our columns. Some debate might, indeed, have been avoided if our correspondents had steadily borne in mind the fact that phenomena must be spoken of as such; and that in speaking of "a wash of colour," we no more refer to either undulatory or any other theory of light, than we do when we speak of sunrise and sunset. But the point which strikes us as deserving the most serious attention is the question how far it is possible, by observations on the physiology of the colour sense, to obtain light on the theory of the production of the optical sensation of colour, and thus on the theory of light itself. As to this, the discovery of one-sided, or one-eyed, colour blindness is one of the utmost importance, and promises results not easy to anticipate. Considering that the proportion of persons suffering more or less from colour blindness is nearly 5 per cent. of the population, it may be confidently expected that research into the special peculiarities of each case will furnish the philosopher with more instances of this very unusual affection. As at present noted, it is the colours at either end of the scale which just elude the perception of the organ of vision. This, in fact, is what might be expected if colour blindness be regarded as a consequence of the partial want of optical susceptibility, arising from an enfeebling of the powers of the optic nerve, or of some portion of the visual apparatus. The point that is here obscure is,—What is the character of the nervous defect that loses the red rays, as distinguished from that which loses the violet? No one-sided green-blindness has been noted. Is it to be expected? Is it not most probable that, as the defect advances from either side of the scale, we are more likely to arrive at blindness to form as well as to tint, than at a third species, so to speak, of affection? This question deserves careful study.

We are the more led to call attention to this subject,—in the hope of leading to the collection of valuable data as to the optical action of the two eyes, as compared with that of one eye alone,—from a communication recently made to us on the effect of light, falling on one eye, in increasing the brightness of an object seen at the same moment only by the other eye. As far as we are aware, this is a new observation. It is generally the case, we apprehend, that objects appear of a different size if viewed by the right or by the left eye. Apparent size is due to the mean power of vision of the two combined. So, at least, we have generally understood. But that clearness of definition is induced by illuminating the eye which does not see the object looked at by the other eye, we have not previously seen stated. It will at once be obvious how closely this remark is connected with the investigation of the phenomenon of one-sided colour-blindness.

The following is the communication from our friend to which we referred. We can bear witness to the careful character of the writer in making and recording his observations:—

"An observation on the effect of light on the sensorium occurred to me a few days ago, which deserves not only to be recorded, but to be carefully studied. I was in a church, lighted by gas; and before me, on a little desk, lay my *pince-nez*, with crystal lenses. Two gaseliers were reflected from the crystal, one as a crown of very sharp, bright points, the other as a line of blurred and more diffused points of light. The lights producing the former reflections were at some distance in front, reflected at an angle of, perhaps, 60°; those producing the latter were higher above me, and reflected at an angle more approaching a right angle. My attention was directed to the two sets of points, by the fact that the unconscious movement of my head made them cross and play upon one another. So far all is quite simple. I soon observed, however, that the position of the reflecting lens was such that I could see the lights in it only with the left eye. With the right eye I could see the glass, but owing to variation of angle, or to the intervention of some other body, there were no points of light on it visible to the right eye, when the left eye was closed.

I found, however, that by looking at the reflecting surface with both eyes open, the points of light, of both kinds, became sensibly brighter, as well as sharper, in definition, than when I looked at the glass with the right eye closed. This, as far as I am aware, is a new observation. Vision was more distinct, considerably, with two eyes than with one, although the points of light observed (which formed a very admirable object for the purpose of experiment), were visible to the left eye alone. If any difference had been anticipated between the two observations it would have been the reverse to that which occurred, as the lens itself was seen by both eyes, but the points of light on it only by one. There was, however, no doubt about the phenomenon, which I studied for more than five minutes with care, and which was invariably reproduced as I opened the left, the right, or both eyes.

I could only conclude that the sensorium was more excited by the use of the two organs of vision at once than by one alone, and that, this being the case, the vision of the left eye was actually aided by the agency of the right, although the luminous object was only visible to the former. This observation is one that I think demands attention."

ON COLOUR THEORIES.

SIR,—Your correspondent and my critic, "R. W. S.," objects to my wandering from the beaten track in having the audacity to dispute Chevreul's *dicta*, although he acknowledges he is not of the same opinion as Chevreul. Mr. Crace also objects to my simple experiments. Now, while both these gentlemen gain the idea I wished to convey, they failed to grasp the reason why I introduced these "absurd experiments." The optical principle I wished to illustrate was somewhat beyond their ken, so much so that I must minutely explain myself. The argument stands thus:—Chevreul says * that "Red, the complementary of green, placed by the side of green, increases its intensity;" and again (in article 43), "place a red wafer or circular piece of paper upon a sheet of white paper, then tint the white paper round the circle with its complementory colour [green in this case, according to Chevreul's theory], gradually soften it off from the coloured circle, when it will be found that the red circle tends to colour the surrounding space with its complementary green."

Then, from this and analogous experiments, he lays down the rule,—and this, indeed, when science was much more an infant than now,—from which we are never to depart, that "complementaries juxtaposed mutually heighten each other." But he does not explain this rule by reference to any principle of optics, simply contenting himself with the idea that when the two coloured surfaces are juxtaposed, as red and green in this case, the red surface physiologically calls up a sensation of green in the eyesight, and that the eyes thus see the green-coloured surface intensified by the addition of this visual green; similarly, that the green surface physiologically calls up a visual red to intensify the red in the same way.

The result of this supposition of his,—for it is not a scientific fact,—is this—and here comes the point of the argument on his side—that the line of contact of these two dissimilar colours will be as distinct as possible, each colour at this point being of its greatest intensity. My argument is that this line of contact, *i.e.*, the meeting of the contiguous dissimilar-coloured surfaces, is not thus heightened, but, in fact, blurred, and becomes in colour somewhat similar to what the results would be if the two distinct colours were compounded. To support and verify my argument, I took the surfaces at an angle to each other; my critics, however, failed to see that I did so to bring the principle, to which the effect so produced is due, clearer to their minds. Since, however, it failed to do so, and I cannot give here the illustration I have drawn supporting my assertions, I would ask them to look upon the upright surface as rebated, that is, turned so that both surfaces are brought into the same plane. The optical principle remains the same. Parenthetically, I would mention that it is a principle of optics that the colours of objects become visible by light being irregularly reflected from their surfaces. Thus, then, the waves producing the sensation of such colours, being scattered in all directions, those at the line of contact will

* Article 39 of Spantin's Translation, 1859.

intermingle with each other, with a result that this line of contact will appear of a compound hue; with red and blue, this compound hue being a violet. That this modification at the line of contact should be more readily seen, I selected small instead of large squares. Among several reasons that make me hesitate in accepting Chevreul's rule, is the fact that it is at the present moment a question whether sensation of light and colour is carried to the brain by vibratory motion on the part of the retina and optic nerve, or whether a chemical reaction occurs amongst the tissues when the eye is performing its duties. Until more is known about the optical structure and the various functions each individual member of it possesses, it were folly to cling hard and fast to Chevreul's physiological idea of the action of the eye.

The above letter is a condensation of one I wrote on April 25th, and another on May 2nd, which, however, were too voluminous to be printed. H. C. STANDAGE.

P.S.—I am glad to welcome "W. C. T.'s" perfect accord as to my views on the subject. Arguments founded on a scientific basis can have but one conclusion,—a true one.

MISCONCEPTIONS REGARDING THE THEORY OF COLOURS.

SIR,—If the *dictum*, "*qui s'excuse s'accuse*," be as applicable to discussion as to conduct, then your correspondent is convicted of carelessness by his letter of last week. It is not for the use of pedantic language on the theory of colour that I contend, but that the treatment of the subject should be consistent with the recognised fact that the laws of the harmony of colour are derived, not from an external source, but from an internal. All modern treatises treat those laws as if they were derived from the former, and though such writers are "pedantic" enough to state that colours are sensations, they reason upon these as if they were objective realities.

The laws of the harmony of colour are the laws of our sensuous constitution. The only practical field of experiment with colour is in the eye itself, and the great point on which I insist is, that the student has always the means of testing for himself what the true complementary of any colour is. I believe I have placed the theory of the harmony of colour on its right basis in my "Revised Theory of Light," and in a way that has never before been attempted. Mr. Spottiswoode was in the chair when I first propounded the theory on which that essay is based, and he admitted that it afforded a sufficient and complete explanation of the phenomena treated. It is the most practical system for all employed in the arts, and whose vision is whole. It requires no effort of memory, and it affords the means of constructing reference-scales.

Difficult, however, as it may be, we must endeavour to frame a nomenclature more consistent with true theory than that in general use. Mr. Crace, even in his last letter, is guilty of a solecism when he speaks of the mixing of colours, which is utterly misleading and at variance with theory. Colours cannot be mixed; we cannot mix sensations. Without being pedantic, it was open to him to have spoken of the mixing of pigments; and "R. W. S." is as inconsistent, whilst professing himself conversant with the true theory, when he speaks of "coloured rays"; and as for naming the colour sensations produced by objects after those produced by the spectrum, that is quite contrary to fact: the spectrum experiment was long subsequent to the naming of colours. W. C. T.

ARCHITECTS AND QUANTITIES.

SIR,—Your correspondent "A. B. C." is to be thanked for exposing the absurdity of the view that an architect should take his own quantities in order that he may amend his drawings. The drawings should be perfect to start with, and if this process is necessary to make them so, I wonder by what parallel process the speaker who advises it corrects the imperfections in his quantities. For imperfect they are from such sources, as too many builders have found to their cost. I have seen some of these precious documents, and I know. Then the charge made for them is always equal to what would satisfy a really able surveyor, and, in too many cases, fifty or sixty per cent. more.

Let young architects make as full and as careful drawings as they can, and then let them hand them over to a surveyor of experience. They will gain greatly by the process, although they will not pocket the percentage. Their clients will be gainers, because the competition of the builders will be keener. The builders will be gainers, because they will not be making random estimates.

The crushing argument against the "home-brewed" quantities is that they are, as a rule, most miserably done, especially the country article.

When I hear an architect gravely argue that he ought to act as surveyor, I wonder much whether he carries the principle further, and wishes surveyors to turn architects? One idea is as good as the other!

QUANTITY MAN.

"CHEAP AND BOLD PLANS FOR CHURCHES."

SIR,—I trust you will allow a Roman Catholic layman to say a few words upon the controversy raised with respect to the Dominican Church at Haverstock-hill.

Whether the charges brought against that particular building are true or not I am unable to settle. I will, however, say this; the columns look too thin, and my experience is that in building what looks too thin generally *is* too thin. Of course, there are exceptions to this rule, and I sincerely trust that the church at Haverstock-hill is one of those exceptions. I am always, however, suspicious when I hear that our clergy and architects are erecting churches upon what they are pleased to call "a bold plan."

"A bold plan" may be very good where there is plenty of money to spend, where the best materials can be used, where constant supervision of the work can be secured, and where requisite solidity can be attained; but I have no belief in cheap boldness, and unfortunately too many of our Roman Catholic churches are of this description, and many very serious accidents have occurred, sometimes not unaccompanied by loss of life. Any person who will look through the building papers for the last twenty-five years will find "Fall of a Roman Catholic Church at ——," or "Serious Accident to a Roman Catholic Chapel," a by no means unfrequent item of news. Only the other day I heard of large sums of money being expended upon "replacing the columns" of two large new churches!

Whoever will have the courage and risk the unpopularity of calling attention to some of our showy, cheap, and unsafe churches, will deserve well, I think, of every

ROMAN CATHOLIC LAYMAN.

DAMAGE TO DURHAM CATHEDRAL.

SIR,—I inclose report of part of the proceedings at the annual meeting of the Archæological and Architectural Society of Durham and Northumberland.

That Society, founded originally by Canon Greenwell and myself, has for some years been doing valuable work in the North of England, in preserving our ancient historical monuments, and its proceedings are never devoid of interest or importance.

At this particular meeting, the President (Canon Greenwell) has called attention to a most serious evil in the steady deterioration of the stonework of the famous interior of the cathedral, from causes which chemical science ought to be able to remove or neutralise. And I have to ask you to give publicity to the facts in the columns of the *Builder*, in order to insure a more wide-spread publicity and a speedy remedy. EDWARD ROBERT ROBSON.

"The President said there was a subject of very great importance which they, as an architectural society, had to do with. They were in danger of losing their cathedral. He did not mean to say it would be blown up by dynamite, or destroyed by any means so sudden; but the work of destruction was quite as effective and quite as certain in the end. It was gradually crumbling away. He had observed that many of the mouldings had lost now their sharpness by this crumbling process, and any one could scrape off much of the surface of the stones with his hands. This destruction was going on over the whole of the cathedral, and unless it was stopped, and no measures had as yet been taken to do so, it would in the course of years prove destructive to great portions of the building. This was very much to be deplored, and they might naturally ask,—What was the cause of it? It was by exposing the surface of the stone to the action of the atmosphere. The stones had been covered for many centuries with whitewash, and when this was removed some sort of wash ought again to have been applied. A wash of lime of a better quality than the ordinary whitewash might have been used. At present the stone was liable to two destructive actions,—one from the stoves and the other from the gas. There could be no question whatever that the stoves and the gas were working in a very injurious manner upon the stones deprived of their protection of whitewash. Under these agencies the stone was constantly being disintegrated, and unless that action was stopped before long the building would be seriously damaged. This was a subject of the very deepest importance. He did not know that they had any power to do anything, but he trusted that the subject would be brought before the cathedral authorities, and that they might take such steps as persons qualified to form an opinion about it might recommend. There was another form of destruction taking place in the cathedral, and that was the formation of a salt upon the surface of the stone. This had been going on for a great number of years in the Dean and Chapter Library, and by this action the mouldings put in about twenty-six or twenty-eight years ago were decaying away. He took it for granted that what was taking place in the library would also take place in the cathedral itself. He had seen it himself, small crystals of a sort of salt upon the surface of the stone."

"Mr. Le Keux said that, in removing the whitewash from the walls of the cathedral, spirits of salt had been used to dissolve the lime. The acid had not been neutralised by any alkali, and it was eating the stone away.

Rev. J. T. Fowler said he thought it was the coke stoves that did the mischief, and not the acid. The latter would soon exhaust itself, but the wasting away was continuous.

The President said the fumes from the coke stoves and the gas were very disagreeable. No doubt a great deal of damage was done in that way.

Rev. J. T. Fowler said the action of gas and coke stoves had been clearly demonstrated in York Minster. There was a certain monument there made entirely of magnesian limestone, and the action of gas and the coke fumes converted it into Epsom salts. You might gather salts by the handful upon the monument enough to last a man for a lifetime. This was the result of the gas and the coke together."

PURE AIR AND RADIATING HEAT.

SIR,—In an article contained in the *Builder*, Mr. Boyd speaks of some one having advocated "the warming of the air of the room by radiation." I should be glad to aid in dispelling a delusion so fatal to the carrying out of all ventilating arrangements as that the air can be warmed by radiation.

It requires no complicated experiments to prove that the contrary is the case, as we are constantly surrounded by many proofs that it cannot be so warmed. For example, we will say a room has been without a fire during a severely frosty night, and in the morning the windows have become coated with ice on the inside: we light a good fire, and the radiation at once flies to this ice, and soon melts it; but it may always be noted that, in the case of an ordinary sash-window, the ice will remain very much longer just above the meeting rails than upon any other part, being protected by the projection of the rails from the direct rays of heat. Whereas, if the air had become warmed by these rays, we might reasonably expect all the ice to leave the top sash before the lower one. And not only at this point of the window may it be seen, but at any point which may be screened from the fire by an intermediate object. This brings me also to mention, as an illustration, the household fire-screen, which would be useless in checking the heat from the fire were the air around made warm by it, and it is well experienced by all that the rays of heat from a fire will travel to the farthest corner of a room, if sufficiently powerful, and where not intercepted by any solid object, which will at once absorb or reflect it according to the nature of the substance.

I am pleased to hear of the important efforts which are being made by the National Health and Kyrle Societies in this subject, and, should you find space to publish my views upon this, one of the weightiest points of the subject, probably some further light would be called forth from other members of the profession or others concerned in it, in order to arrive at a safe theory for all those to work upon who are intending to exhibit appliances for warming and ventilation at the forthcoming exhibition projected by the above-named societies.

S. R. EGLINGTON.

CHRIST CHURCH, ZANZIBAR.

IT may be useful to add to the particulars given in our last that the internal dimensions of the church are 88 ft. by 38 ft. between the walls, and 28 ft. between the marble columns, which project therefrom and carry the vault. The apse is 25 ft. 6 in. in addition, the walls being 5 ft. thick generally.

Railways in Japan.—The *Japan Mail* announces that the Takasaki railway has been definitely sanctioned by the Government, and gives particulars of other proposed lines, the total cost of which, including the Takasaki line, is roughly estimated at 19,000,000 yen.

THE PLUMBERS' COMPANY.

SIR,—Mr. A. Stewart Harrison takes exception to Mr Hellyer's remarks in his lecture on the apathy of the Plumbers' Company in not furthering the interests of their craft, and states that the Company, at the instigation of Mr. George Shaw, resolved to offer the freedom of their Company to applicants who passed a certain examination, &c.

This offer was made four years and a half after Mr. Shaw brought his motion forward, and, by a curious coincidence, just at the time when a new Government came into office pledged to look into and reform any abuses that might exist in the City companies. I made application, and received a form, which was duly filled up and returned with fifteen years' character from different City firms, both as to ability as workman and foreman. After several months' interval I received a form, giving me notice that the examination of candidates would take place at the City and Guilds Institute. I applied for, and obtained, the particulars of the examination, and then found that the offer of the Company was nothing more or less than a delusion and a snare. What chance has a working-man with about three months' preparation to pass with honours (and it is imperative for him to do so to be successful) an examination in which, besides the art and science of plumbing, he has to successfully answer questions on the following subjects:—

Manufacture of metals; gasfittings; measurement of pressure of gas in a main or pipe; practical, plane, and solid geometry; machine construction and drawing; theoretical mechanics; applied mechanics; inorganic chemistry, &c.

I leave the trade and the public generally to judge for themselves what chance even a superior workman has to pass such an examination successfully.

J. BARNES.

THE LECTURES ON PLUMBING.

SIR,—Like your correspondent "T. S.," on p. 685, I read with much pleasure your report of Mr. S. S. Hellyer's lecture upon this subject, and I look forward with pleasant anticipations to those to follow. I hope the lectures will be productive of good practical results.

In reply to the lament by "T. S." that no one has hitherto stepped forward to do anything to improve plumbing, I fear the said remark only shows his ignorance of much that has been done and has been going on for years back, to help to improve plumbers, and done, too, by plumbers for plumbers.

I cannot join with "T. S." in hoping that Mr. Hellyer's lectures will help to "restore plumbing to its original state." I do not desire its progress to be either backward or downward, but forward and upward. The best old plumbers were ignorant of much that we now know, and even yet only an extremely small percentage understand how to do their work upon the best hygienic principles, and so as to secure the greatest amount of safety to the inmates.

It is not "some sanitary organisation for the inspection of dwellings" that will do much good to the general public, but proper Government inspection, and that carried out by duly qualified officials when the houses, &c., are being built.

W. P. BUCHAN.

SIR,—Mr. Hellyer has thought fit to begin by thoroughly abusing the journeymen plumbers. Abuse is neither argument nor information, and always shows a weak case. What the London journeymen plumbers require is somebody to show them something they are unacquainted with, and there was some hope in this case that something different from what has hitherto been done would be attempted.

Having worked as a practical plumber in London for over forty years, I have no hesitation in asserting that the London plumbers can execute anything that has been done before or is likely to be required at present. They have gone almost to every city in the world and introduced their trade: consequently their heads are not quite so vacant as some of their slanderers'.

I am quite aware that it is extremely difficult for even a plumber to say anything new, but I think if the lecturer would give us the best methods of solving some of the following questions, it would interest the junior members of our trade, and refresh the memory of some of the older ones, and the questions are all sanitary:—

1.—How to extract the poison and muck out of our solder.

2.—Half a dozen different methods of preventing pipes from freezing.

3.—The best way of making a taper funnel pipe out of lead entirely, not cast.

4.—The best and quickest way of covering a coffin with 3½ and also 7, and precautions necessary at the soldering down.

5.—How to tap the main under pressure say from 40 to 80 on the inch.

6.—How to prevent a T-trap from syphoning out.

7.—A method of ventilating soil-pipes without poisoning your neighbours.

These are simply things that are done every day, and upon which a diversity of opinion exists.

J. W. GOODSON.

*** To some other correspondents on this subject we would suggest a little patience: they may hear what they desire if they wait.

PROPOSED PUBLIC BATHS, WIGAN.

SIR,—I send you a copy of the instructions given to architects desirous of competing for the above.

By paragraph five you will see that they intend to spend 5,000*l*. Now, to prepare drawings and specifications for a building such as this, is fully worth 2½ per cent. on the outlay, say 125*l*.

By paragraph seven it is very evident they intend to get two sets of plans and specifications worth 250*l*. for the magnificent sum of 30*l*.

Surely, sir, architects had far better speculate a little on the Stock Exchange than compete under such conditions.

J. M.

*** Architects who have any respect for their profession will not compete on the terms offered by the Wigan Committee.

A New Church and Convent have just been commenced at Dumfries, from the designs of Messrs. Pugin & Pugin, of Westminster. Mr. John Devlin, of Glasgow, is the contractor.

OBITUARY.

Mr. Samuel Palmer, the well-known water-colour painter and etcher, died at his residence, Reigate, last week.

Mr. Edward Chance, a partner in the well-known firm of Chance Brothers, of the Spon-lane Glass Works, Birmingham, died on the 28th ult., in London. His death was due to bronchitis. Mr. Chance was born in 1824.

Mr. Henry Pease, of Darlington, died at his London residence on Monday evening last, in his seventy-fifth year. He was the son of Edward Pease, the father of railways. The official records of the Stockton and Darlington Railway Company, the earliest in the world, show that when quite a youth, and soon after the line was opened, he took an active part in the direction of the affairs of that undertaking. Since that time he had been on the board of management, and when the Stockton and Darlington was merged in the North-Eastern Railway Company he still retained his seat, and was, in fact, the oldest railway director in the world. Six years ago, when the Railway Jubilee was celebrated at Darlington, Mr. Pease was the centre of the demonstration which marked the first half-century in the history of railways.

Mr. James John Stevens, M.Inst. C.E., founder and head of the firm of Stevens & Sons, railway signal and gas engineers, Darlington Works, Southwark Bridge-road, died at his residence, Clapham-common, a few days since, at the age of seventy-four. The business of the firm started almost with the commencement of railways, the deceased being the original inventor and patentee of the semaphore-signal and its various improvements from time to time. On the conclusion of peace after the Crimean war, the firm was employed by the Government to carry out the gigantic gas illuminations which were given in honour of that event.

Mr. G. S. Hudson, the senior member of the Court of the Plumbers' Company, died at Greenwich, on the 21st ult., in his eightieth year.

COMPETITIONS.

Fulham Infirmary.—The clerk of the Fulham Board of Guardians announced, at their meeting on the 26th ult., that 140 copies of the conditions of competition had been applied for. It was resolved to extend the time for sending in drawings to the 1st of September.

Newton Heath, Manchester.—The new Church of St. Anne is about to be erected, from the designs of Mr. A. W. Smith, of Manchester and Liverpool, whose plans were selected in a limited competition.

ERECTION OF ARTISANS' DWELLINGS IN IRELAND.

A SPECIAL meeting of the Castlebar Town Commissioners was held last week, to take into consideration the most suitable means of erecting comfortable dwellings for the artisan classes. A petition was read from the artisans of the town, praying the Commissioners to undertake the formation of a company for the purpose, and a deputation waited on the Commissioners, and stated that if 500*l*. were raised in shares, it would be sufficient, if 2,000*l*. were borrowed, and the debt could be paid in instalments. It was also suggested that if 500*l*. were raised and 1,500*l*. borrowed, they could build twenty cottages at 100*l*. each. A deputation was appointed to wait on Lord Lucan's agent, for the purpose of selecting suitable sites in the town.

Miscellanea.

Technical Education.—His Royal Highness the Prince of Wales has accepted the office of president of the City and Guilds of London Institute for the Advancement of Technical Education, and has expressed his willingness to lay the foundation-stone of the central institution at South Kensington during the month of July next.

Value of Land at Fulham.—The important freehold building estate, known as Bagley's Market Garden, situate at Sand's End (lately advertised in our columns), comprising a detached residence, with grounds, outbuildings, cottages, and 38a. 0r. 31p. of land, was sold by auction by Messrs. Philip D. Tuckett & Co., at the Mart, on Tuesday last, for 32,500*l*.

The Sunday Society.—The sixth public annual meeting of this society was held in the large hall of the Freemasons' Tavern on Saturday afternoon last. The retiring president, the Earl of Dunraven, occupied the chair at the commencement of the proceedings, and, after a few remarks, vacated the chair in favour of the president for the next twelve months, Mr. Thomas Burt, M.P., who delivered a sensible address. On the motion of Mr. Charles H. Hopwood, Q.C., M.P., seconded by the Right Hon. the Earl of Dalhousie, the following resolution was adopted, viz.:—

"That this public meeting accepts the sixth annual report of the Sunday Society as a most satisfactory indication of progress made during the past year, and, though regretting that the state of public business prevented the question from being brought before the House of Commons, it desires to record its high appreciation of the leadership of the Earl of Dunraven, which so nearly led to victory in the House of Lords that the majority against the opening of the National Museums and Art Galleries on Sundays was reduced to seven; and that Mr. George Howard, M.P., be requested to give notice in the House of Commons of the following resolution for next session, viz.:—'That inasmuch as all opposition to the action of her Majesty's Government in opening on Sundays the National Museums and Galleries in the suburban districts of London and Dublin has entirely ceased owing to the good results which have followed such opening, this House is of opinion that the time has now arrived for extending this action to all institutions of a like character, it having been most conclusively shown that large numbers of the people rejoice at every opportunity that is afforded them of spending Sunday intelligently, and with due regard to his preservation as a day of rest and cessation from ordinary work and amusement.'"

Another resolution was proposed by Mr. P. H. Rathbone, J.P., of Liverpool, and seconded by Mr. G. Howard, M.P., to the effect that the meeting trusted Mr. Gladstone would not allow the session to pass without fixing a day for the reception of a deputation from the society. This was carried.

Plumbers in America.—The Bill for licensing plumbers, which has for some time been pending before the New York Legislature, is likely to become a law, and the newspapers are discussing it. The *Metal-Worker*, one of the best of the former class, denounces it as useless, and predicts that it will soon be observed only as a cloak for corrupt practices of various kinds. The Bill requires that the names of all licensed plumbers shall be published once a year in the *City Record*, which the *Metal-Worker* regards simply as a printing "job"; while the provision that the Board of Health shall approve plans for plumbing before they can be executed it condemns, on the ground that the members, even of the present Board, cannot be expected to judge of the merits or demerits of an intricate piece of work, and under a corrupt administration too much opportunity would be given for extorting money by the exercise of this discretion. The daily papers, on the contrary, according to the *American Architect*, hail the bill as a means of deliverance from all sanitary ills, and denounce in unmeasured terms those who oppose its passage as enemies of their kind. "Probably the most judicious attitude would be about midway between these two. While no legislation can do much to improve the workmanship of the careless and ignorant, there are some grosser faults which can be prevented, if the administration of the law is efficient and honest, and this is no small gain. Great as has been the outcry about bad construction in New York, it is unquestionable that contractors as well as architects have a wholesome respect for the building law, and that for every case of criminally bad workmanship which is brought to light, a score are prevented by the inspector's warnings, and there seems to be no reason why a similar amelioration in the average character of drainage work should not be affected by analogous means."

The Eddystone Lighthouse.—The last coping-stone of the new Eddystone Lighthouse was unexpectedly laid on Wednesday last by the Duke of Edinburgh. His Royal Highness, who is on an official visit of inspection of the Coastguard stations, left Falmouth in the morning in the *Lively*, and landed on the rock and went through the old lighthouse. Thence he repaired to the new lighthouse, which has now been built to its intended height. Just as the Royal party arrived, the workmen were about to place the last stone to the cornice of the tower. This operation was immediately stopped in order that the Duke might perform the ceremony himself. After distributing the cement, his Royal Highness placed the stone in position, and, amid cheers, declared it to be well and truly laid. The Duke, as Master of the Trinity Board, laid the foundation-stone on the 19th of August, 1879.

New Museum and Library for Dublin.—In the House of Commons, on the 26th ult., Mr. Dawson asked the Vice-President of the Council whether, before deciding on any plans for the building of the new Science and Art Museum and National Library in Dublin, the Corporation of Dublin would be consulted; and whether, in the construction of the National Library, regard would be had to the improved mode of construction which separated the public reading-rooms from those in which the books were stored.——Mr. A. M. Sullivan also asked whether, considering the number of years the project had been under consideration, the Government would use all their exertions to bring it to a steady completion.——Mr. Mundella: There has been no delay since the matter came into our hands, except what we have experienced from the City of Dublin itself. In consequence of local opposition, we have been thrown back upon the Kildare-street site, for which, in concert with the Board of Works, we are making arrangements to secure plans by public competition. I have no doubt an opportunity will be given for the exhibition of the competing plans, and their criticism by the Corporation and the public at large. The Government will do what they can to secure the best arrangements in the library.

The George Stephenson Centenary Celebration is likely to give an enormous impetus to the demand for what may be termed locomotive literature. Thanks to such men as Mr. Samuel Smiles and Mr. Michael Reynolds, the public appetite may be easily gratified, for both have produced works, still current and revealing with graphic exactitude all the incidents in the lives of Stephenson, his contemporaries, and many of their successors, together with descriptions of the important works they each and all effected. Without wishing to be invidious, we should specify as being recently published a perfectly reliable and cheap book of the kind named, Reynolds's "Model Locomotive Engineer" (in which the early struggles of Stephenson are set forth with rare literary skill), "Engine-Driving Life," and "Locomotive Engine Driving." These are all published at 7, Stationers' Hall-court, Ludgate-hill.—*Foreman Engineer.*

St. Margaret's Churchyard, Westminster.—The Metropolitan Board of Works has resolved to contribute 1,000*l.* to the funds necessary to the carrying out of the improvements in the front of St. Margaret's Church, Westminster. The total sum required was estimated at 3,500*l.*, of which her Majesty's Board of Works have agreed to give 1,500*l.* The balance of 1,000*l.* will be covered by private subscriptions. We now wait to see what will be done.

Masonic.—At the meeting of the Grand Lodge of Mark Master Masons, held at the Criterion, Piccadilly, on the 31st ult., it was announced that alterations were being made to premises in Red Lion-square to suit the requirements of the Grand Lodge, under the direction of Messrs. R. W. Edis and C. H. Driver, Past-Grand Superintendents of Works. Mr. Henry Lovegrove was at the same meeting appointed Grand Superintendent of Works.

Nottingham Castle.—The view of Nottingham Castle in the sixteenth century, which we reproduced, as stated, from the *Illustrated London News*, to illustrate "G. T. C.'s" paper on Castles (p. 581, *ante*), was taken, we find, from a work on Nottingham and its Castle, written and illustrated by Mr. T. C. Hine, F.S.A. (Hamilton, Adams, & Co.) We gladly mention this; the work is an interesting and valuable one.

Scandinavian Art Exhibition.—A Scandinavian art exhibition was opened in Gothenburg on Wednesday, June 1st. It is stated that most of the prominent painters and sculptors of Sweden, Norway, Denmark, and Finland have contributed largely to the exhibition, which contains upwards of 1,000 paintings, marble statues, water-colour drawings, woodcuts and etchings, architectural drawings, medals, &c.

Fire at a Builder's.—On the night of the 27th ult. a fire broke out upon the premises of Messrs. Brass & Co., builders, situate at 47, Old-street, St. Luke's. The alarm was given by a passer-by, who saw smoke proceeding from the extensive building used as a workshop and store. The fire (the cause of which is unknown) was not extinguished until a great deal of damage had been done.

An Industrial Art Exhibition at Manchester was opened by the Mayor, in the Islington Public Hall, Ancoats, on Wednesday last.

Glass-sellers' Company.—The Court of the Worshipful Company of Glass-sellers have given notice that they are prepared to award a sum not exceeding 110*l.* in prizes, for essays on the "Past and Present Position of the Glass Trade," as follows:—50*l.* for an essay on the "Glass Trade in all its Branches"; 20*l.* for an essay on the "Trade in Crown, Sheet, Plate, Rolled, and Cathedral Glass"; 20*l.* for an essay on "Flint and pressed Glass"; and 20*l.* for an essay on "Bottle Glass." Competitors will be expected to consider the present state of the trade, as compared with its condition in foreign countries. The Court, however, are not desirous of inducing the writers to prepare historical notices of the trade, and they would prefer that the writers should deal with historical matters only so far as they bear upon the present state of the British glass trade. The essays must be sent in not later than the 31st of January next, to the hon. clerk, at the office, 58, Gracechurch-street, E.C., from whom further particulars can be obtained.

Proposed Hospital in Covent Garden.—The *Lancet* calls attention to the inexpediency of the proposal to erect a building to be used as a hospital for "stone" cases in the vicinage of Covent-garden. It is inexplicable, says our contemporary, that the site chosen should have been selected. The noise and offensive emanations from the market render the locality singularly unsuitable for any institution which is to be used as a house of refuge for the sick. What makes the incongruity of the present proposal conspicuously great is the fact that "stone" cases involve operative processes of especial danger, exposing the patient to peculiar risks of blood-poisoning, and requiring a plentiful supply of fresh air, with perfect quiet. Is it too late to reconsider the scheme?

Selwyn College, Cambridge.—The foundation-stone of Selwyn College, Cambridge (in memory of the late Bishop of Lichfield), was laid on Wednesday last by the Right Hon. the Earl of Powis, Lord High Steward of the University. The site chosen for the new college is in the Grange-road, at what is known as "the backs" of the present college. The architect is Mr. Blomfield, and the building is to be of red brick with stone dressings. The sum already subscribed amounts, in round numbers, to 30,000*l.*, of which, after paying for the site, enough remains for the erection of buildings as provided for in the contract, to accommodate sixty undergraduates.

The South Metropolitan Gas Bill.—On the 20th ult. a Select Committee of the House of Commons passed the Bill to enable the South Metropolitan Gas Company to construct new works on the south bank of the Thames, near Greenwich, and to raise additional capital. The Bill was opposed, on behalf of the gas consumers, by the Metropolitan Board of Works, who succeeded in reducing by half a million the amount of capital sought, namely, 1,500,000*l.* An attempt was also made, but without effect, to induce the committee to reduce the standard price of gas as fixed by the Act of 1876.

Art-Exhibition at Windsor.—Under the patronage of the Queen, Prince and Princess Christian, and Prince Leopold, a fine arts loan exhibition will be held at the Albert Institute, Windsor, in the month of July. The committee is an influential one. It is intended that the exhibition shall comprise pictures, statuary, bronzes, tapestry, ivories, china, and other objects of interest.

Infirmary, West Bromwich.—At the meeting of the West Bromwich Board of Guardians, on Monday last, it was resolved to adopt one of the two plans submitted by Mr. Henman, architect, for the erection of a new infirmary. The proposed outlay is 14,000*l.*

New Associate of the Royal Academy.—At a General Assembly, held at Burlington House on Thursday evening last, Mr. George Aitchison, B.A., F.R.I.B.A., was elected an Associate, in the room of the late Mr. William Burges.

TENDERS

For construction of roads and sewers, on the Honor Oak Estate. Messrs. Weatherall & Green, surveyors:—

J. G. B. Marshall	£3,333	0	0
R. Tyler	3,270	0	0
McKenzie & Co.	2,946	0	0
G. Acock	2,783	0	0
J. Dyer	2,773	0	0
W. Harris	2,743	0	0
A. Walker	2,738	0	0
H. Woodham	2,618	0	0
W. J. Woodham	2,570	0	0
Nowell & Robson,* Kensington	2,320	0	0
G. Neal	2,300	0	0
F. Taylor & Co.	1,970	0	0

* Accepted.

For Northaw Church, Barnet, Herts, with tower. External face of Ancaster rubble, and seating, &c., of oak. Messrs. Kirk & Sons, architects. Quantities by Mr. Geo. Hackford:—

Martin & Wells, Aldershot	£18,412	0	0
Scales & Morris, Hertford	13,612	0	0
Wm. Wade, St. Neots	13,500	0	0
Thos. Hunt, Ware	12,590	0	0
Rudd & Son, Grantham	12,100	0	0
Goddard & Sons, Farnham	12,060	0	0
Miskin, St. Alban's	11,956	0	0
W. Hampton, Hoddesdon	11,838	0	0
Thos. Williams, London	11,774	0	0
W. C. Jones & Co., Gloucester	11,750	0	0
Rayment & Son, Hertford	11,213	5	2
Bates, Stevenage	10,717	18	9
Bentley, Waltham Abbey	9,930	0	0
G. Gibson, Southall	9,929	0	0

For schools, at Sunninghill. Messrs. Morris & Stallwood, architects. Quantities supplied:—

Kirk & Randall	£2,098	0	0
Pilgrim & Son	2,055	15	0
W. H. Norris	1,963	0	0
Geo. Reavell	1,911	16	0
Jones & Co.	1,907	0	0
Strong Bros.	1,903	10	0
Kingerlee	1,893	0	0
Woodbridge	1,879	0	0
Bottrill	1,858	14	0
Foreman	1,851	0	0
Partlo	1,851	0	0
Williams	1,805	0	0
W. P. Reavell	1,796	0	0
Pither	1,787	9	0
Simonds	1,773	0	0
Watson, Ascot	1,685	10	0

For rebuilding a warehouse in Bevis Marks, for Mr. Deputy Stapleton. Messrs. Hammack & Lambert, architects:—

J. & H. Cocks	£1,565	0	0
W. Cubitt	1,195	0	0
J. H. Johnson	993	0	0

For the erection of four cottages, St. James-road, Croydon. Messrs. Herbert Bean & Burnett, architects:—

Sharpe & Mills	£1,010	0	0
Balaam Bros.	900	0	0
Samuel Chafen	875	0	0
Crisp & Tomlin (accepted)	853	0	0

For repairing a warehouse, in Duckett-street, E., after fire, for Mr. Weeden. Mr. C. A. Legge, architect:—

Judd	£198	0	0
Lusk	175	0	0
Croft	170	0	0
Parrish	145	0	0

For rebuilding premises, No. 42, Tufton-street, Westminster. Messrs. Isaacs & Florence, architects. Quantities supplied by Mr. L. C. Riddett:—

Bamford	£1,220	0	0
Scrivener & Co.	1,048	0	0
Tyerman	1,037	0	0
Boyce	1,008	0	0
Wire	994	0	0
Stimpson & Co. (accepted)	977	0	0

For the superstructure of the Army and Navy Hotel, Victoria-street, Westminster. Mr. F. T. Pilkington, architect. Quantities by Mr. H. D. E. Earl, Edinburgh:—

W. & D. McGregor,* Edinburgh	£54,446	0	0

* Accepted.

For alterations to shop-front, and repairs to house, 266, Camberwell-road. Mr. C. W. Lovett, architect:—

G. & S. Fisher	£197	0	0
Batley	195	0	0
Stevens	182	0	0

For completing semi-detached residences, Nos. 1, 2, 3, 4, 5, 6, and 7, Vaughan-villas, Devonshire-road, Forest-hill, for Mr. G. J. Coldham and Mr. Vaughan Bretell. Messrs. Ebbetts & Cobb, architects:—

Brown	£1,940	0	0
Newland	1,930	0	0
Holt	1,800	0	0
Nixon	1,797	0	0
Steel Bros.	1,720	0	0
Sanders	1,520	0	0
King	1,500	0	0
Williamson	1,380	0	0

For the erection of a warehouse, in Hales-street, Coventry, for Messrs. Matterson, Huxley, & Watson. Mr. Herbert W. Chattaway, architect:—

D. Esor, Coventry	£2,320	0	
J. Marriott, Coventry	1,950	0	0
C. Garlick, Coventry	1,898	0	0
J. Worwood, Coventry	1,847	0	0
Hallam & Co., Coventry	1,825	0	0
T. Mayo, Coventry	1,766	0	0
C. Haywood, jun., Coventry	1,680	0	0
Bacon & Son, Foleshill (accepted)	1,563	17	0

For rebuilding the premises, 20 and 21, Villiers-street, Strand, for Messrs. Corazza Gatti. Mr. A. J. Bolton, architect:—

Heath	£5,096	0	0
G. S. S. Williams & Son	4,970	0	0
Laing & Son	4,885	0	0
Marks	4,880	0	0
John Clemence	4,595	0	0
Geo. Gaisford	4,456	0	0
Hook & Oldrey	4,427	0	0

For house, Gorleston, Great Yarmouth, for Mr. J. Bately. Mr. J. W. Cockrill, architect:—

Harbert, Great Yarmouth	£1,335	5	0
Springall, Great Yarmouth	1,000	0	0
Bray, Great Yarmouth	975	0	0
Thos. Howes,* Great Yarmouth	929	0	0
L. W. Blyth, Gorleston	924	0	0

* Accepted.

For additions to a house at Aldenham, Herts, for Mr. C. T. Part. Mr. Ralph Nevill, architect:—

Longmire & Burge (accepted)	£1,613	0	0

For pulling down and rebuilding 8, Porchester-terrace, Bayswater. Mr. A. E. Hughes, architect. Quantities by Messrs. Sandell & Corderoy :—

Simpson & Co.	£6,600 0 0
Higgs & Hill	6,494 0 0
Williams & Son	6,393 0 0
Longmire & Burge	6,290 0 0
Mark Manley	6,157 0 0
McLachlan & Sons	6,085 0 0

For alterations, &c., at Hornton Lodge, Kensington. Messrs. I'Anson & Sons, architects. Quantities by Mr. D. Campbell ;—

		Deduct for Pitch Pine.
Kinnimont & Sons	£1,595 0 0	£189 10 0
McLachlan & Sons	1,490 0 0	219 0 0
Fish	1,385 0 0	133 0 0

For completion of houses on the Norbury Manor Estate, for Messrs. Carter. Mr. E. P. Loftus Brock and Mr. R. C. Murray, joint architects to the Estate :—

E. Julian & Co.	£4,028 0 0
Mattock Bros.	3,896 0 0
Niblett	3,757 0 0
Howe & White	3,650 0 0
Syme & Duncan	3,100 0 0
Peacock Bros.	2,929 0 0
Allen & Hurden (accepted)	2,550 0 0

For completing five houses, on the same Estate, Thornton-heath end :—

Howe & White	£2,020 0 0
Mattock Bros.	1,849 0 0
Syme & Duncan	1,776 0 0
Niblett	1,769 0 0
Peacock Bros.	1,530 0 0
Allen & Hurden (accepted)	1,500 0 0

For alterations at the Lord Clyde, Rochester-row, for Mr. Silcock. Quantities supplied. Mr. H. J. Newton, architect :—

Vears & Co.	£952 0 0
Richards	929 0 0
Pickersgill	839 0 0
Gill	727 0 0
Beale	712 0 0
Walker	689 0 0
Stiling (accepted)	570 0 0

For alterations and re-decorations to the Royal Standard public-house and music-hall, Victoria-street, for Mr. Wake. Mr. H. J. Newton, architect :—

Burman	£697 0 0
Creaton	553 0 0
Richards	550 0 0
Vears & Co.	447 0 0
Howlett	350 0 0
Godden (accepted)	387 0 0

For factory buildings, shaft, &c., at Rainham, Essex. Mr. G. Perry, architect. No Quantities :—

J. O. Richardson	£979 0 0
Philley	918 0 0
Crabb	895 0 0
Baxter	784 0 0

For building a house, at Hale Park, Walthamstow. Messrs. Gover & Punnett, architects :—

Judd	£640 0 0
Cummings	595 0 0
Lipscombe	545 0 0

For addition to house, Oakleigh Park, near Barnet. Mr. M. L. Saunders, architect. Quantities not supplied :—

A. Dorman	£490 0 0
Staines & Son (accepted)	464 0 0

For re-instating premises, 65, Southwark-street, after fire, for Messrs. Easton & Anderson. Mr. F. Chambers, architect :—

W. & H. Castle, accepted.

For the erection of the new church, at Bexley, Kent (exclusive of tower and spire). Mr. George Low, architect. Quantities by Messrs. Johnstone & Paine :—

Naylar & Sons, Rochester (accepted) £4,769 0 0

For alteration to the Skin Market, Bermondsey. Messrs. Elkington & Son, architects : –

Greenwood	£575 0 0
Bullers	548 0 0
Stephens	520 0 0
Tarrant & Son	473 0 0

For alterations to 48, Strutton-ground, Westminster. Mr. John Calder, architect :—

Smith	£578 0 0
Francis	545 0 0
Percy	538 15 0
Stephens	530 0 0

For the erection of house, on the Bush-hill Park Estate, Enfield, for Mr. Henry Povey :—

Uff, accepted.

For the erection of school buildings, at Lyndhurst-grove, Lambeth division, for the School Board for London. Mr. E. R. Robson, architect. Quantities supplied by Mr. T. Thornton Green :—

Marsland	£10,985 0 0
Higgs & Hill	10,980 0 0
Atherton & Latta	10,847 0 0
Lathey Bros.	10,709 0 0
Jerrard	10,543 0 0
Kirk & Randall	10,517 0 0
Nightingale	10,481 0 0
Shepherd	10,354 0 0
Grover	10,240 0 0
Tongue	9,992 0 0

For road-making and sewage works, on the Park Hill-rise Estate, Upper Tooting, for the London and Suburban Land Company. Mr. Gritten, surveyor. Quantities supplied by Mr. Alexander M. Greig :—

Rigby	£2,760 0 0
Neal	2,559 0 0
Jackson	2,350 0 0
Aldred	2,290 0 0
Ford & Co. (accepted)	2,175 0 0

For building residence (Thames View House), St. Margaret's, Twickenham, for Mrs. Foster. Mr. Witherington, architect :—

Taylor & Parfitt (accepted) £2,103 0 0

For pulling down and rebuilding 60 and 62, Weston-street, Bermondsey, for Mr. Simon. [Mr. Tabberer, architect :—

Taylor & Parfitt (accepted) £1,563 0 0

Wensley House, Woodford.—Mr. R. Abraham's estimate was 794*l.*; not 974*l.*, as stated last week.

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